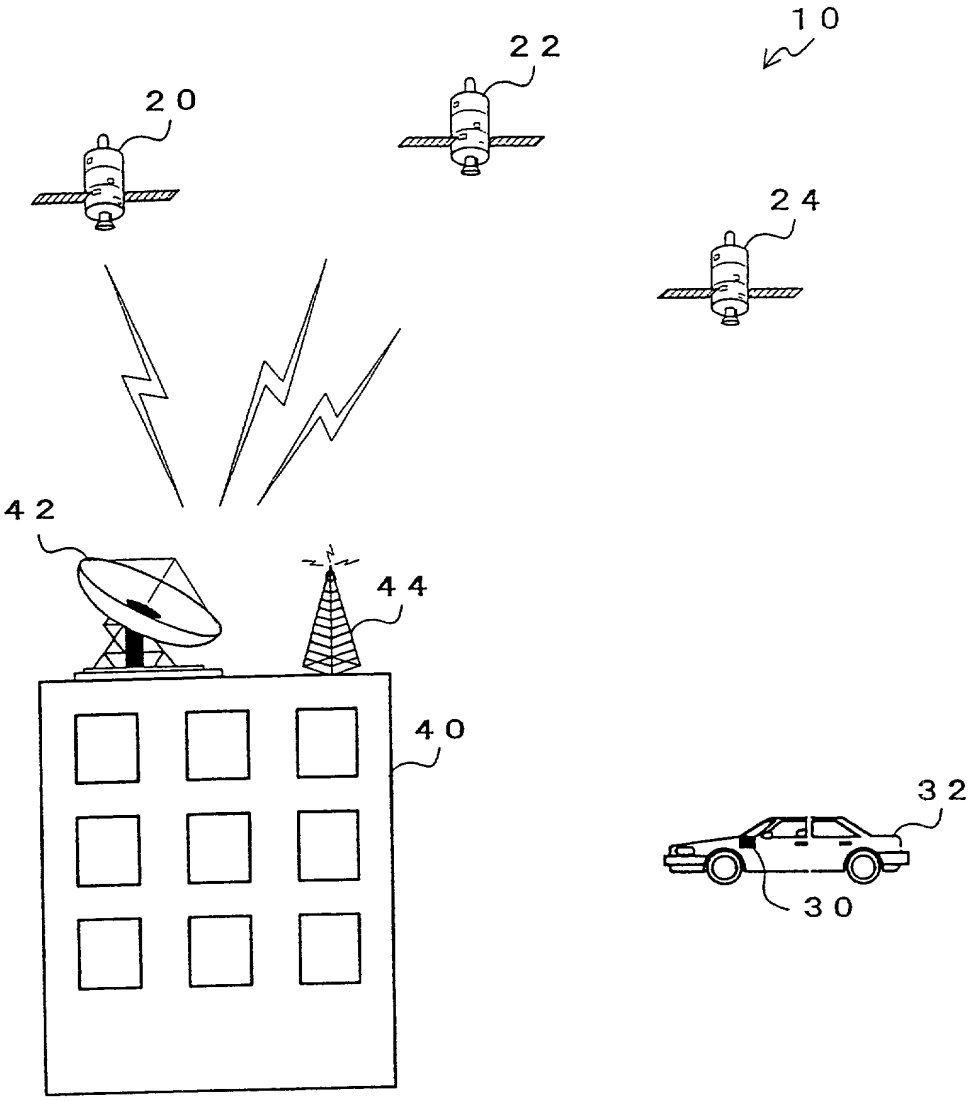
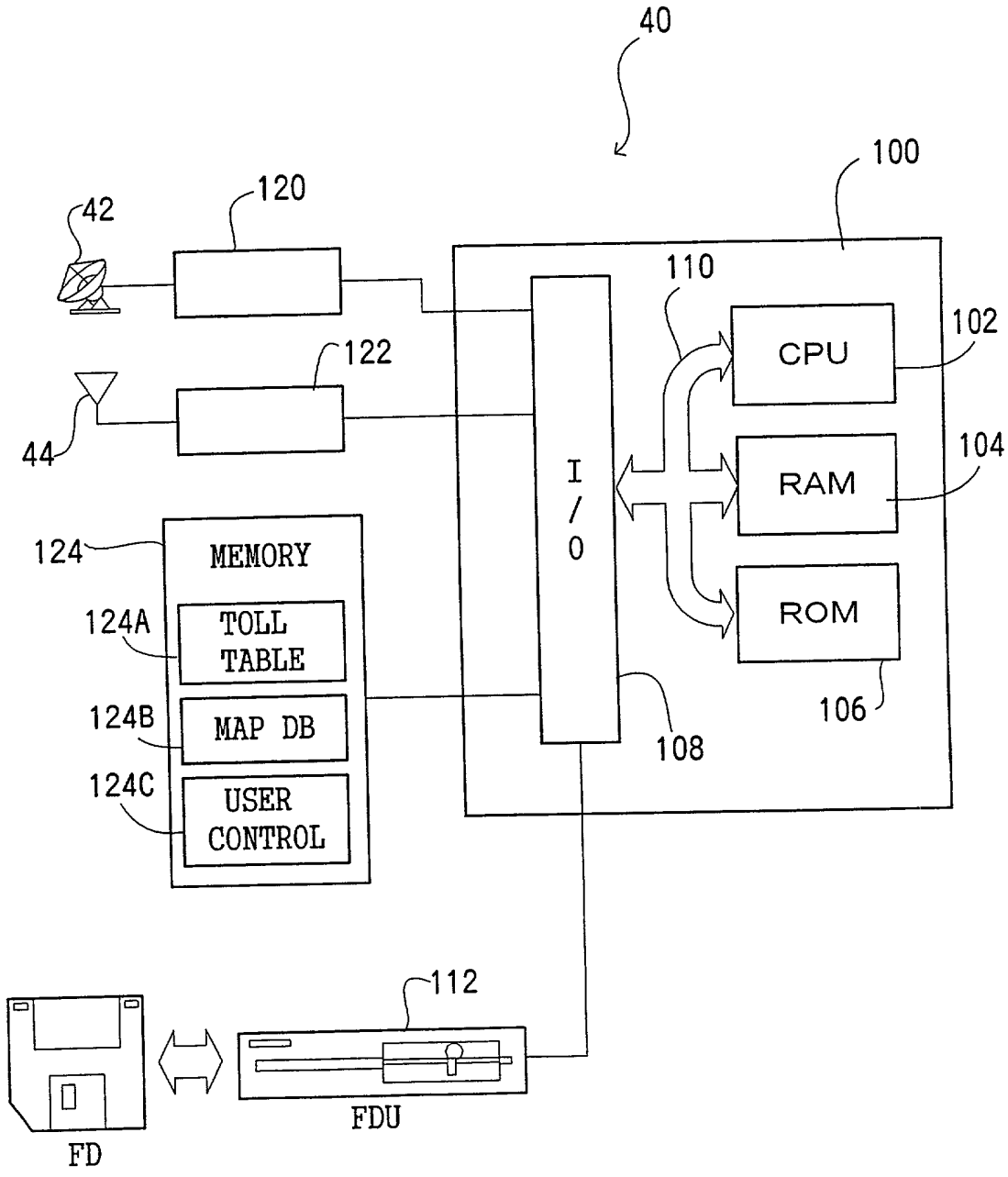
FIG. 1



F I G. 2



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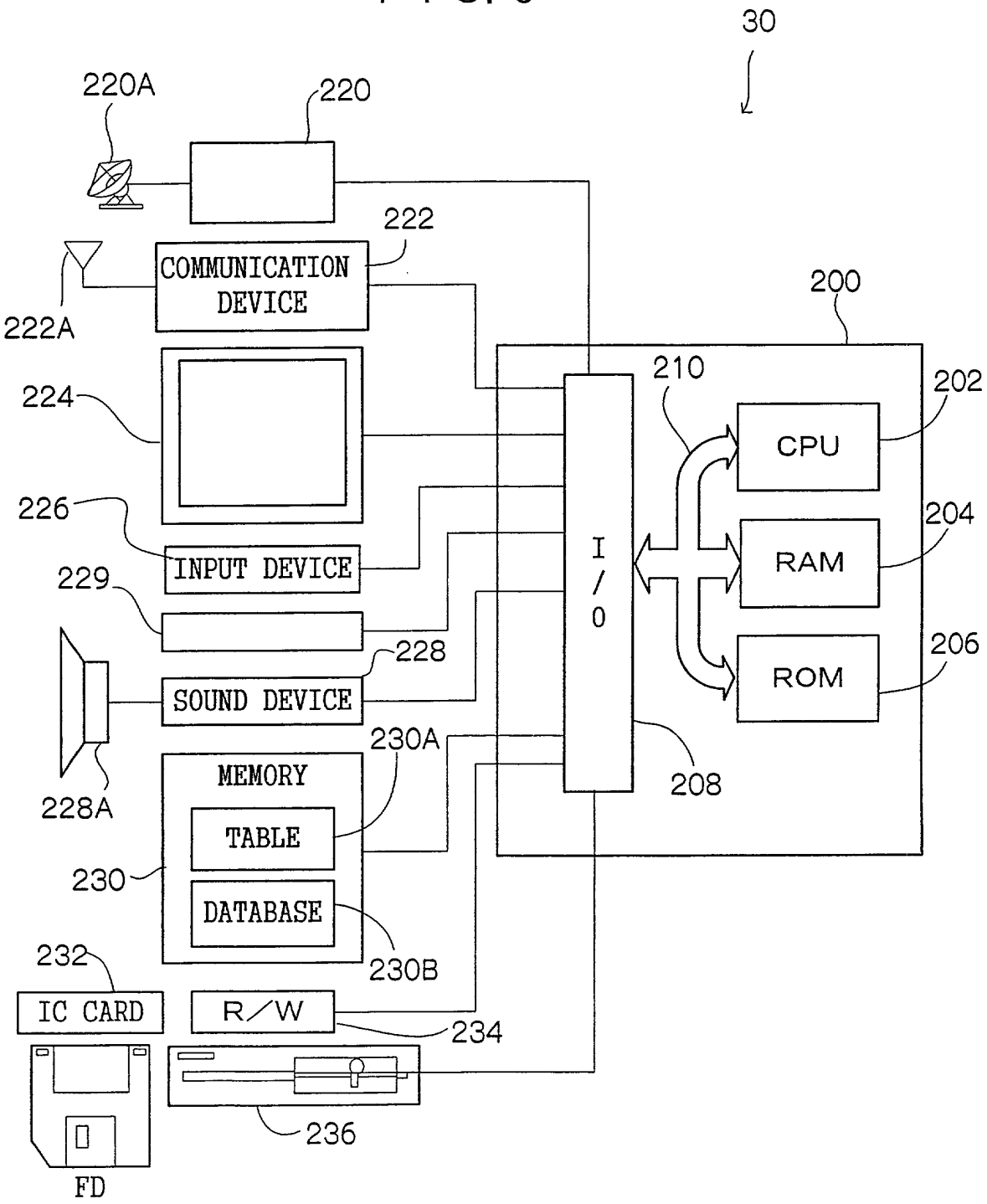
F I G. 3



FD-2020-960926

FIG. 4 A

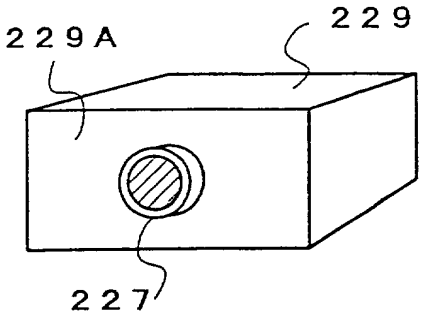


FIG. 4 B

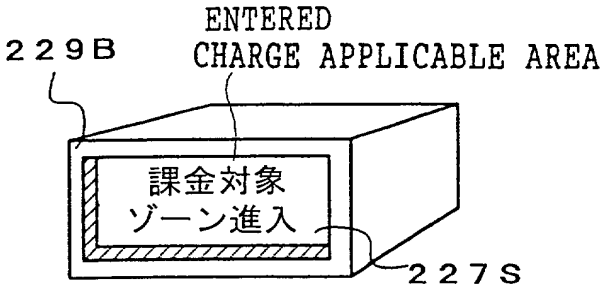
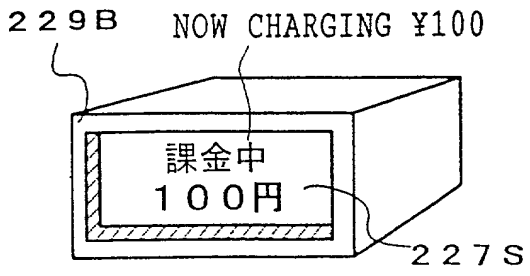


FIG. 4 C



F I G. 5

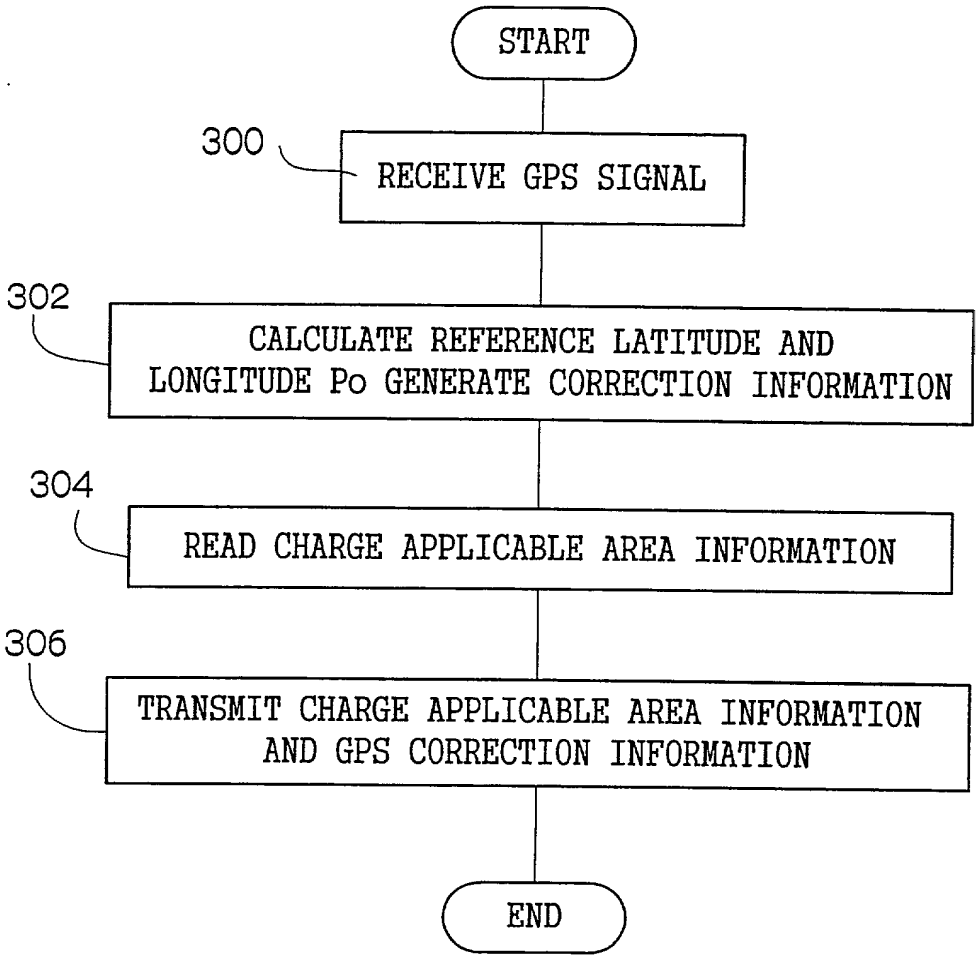


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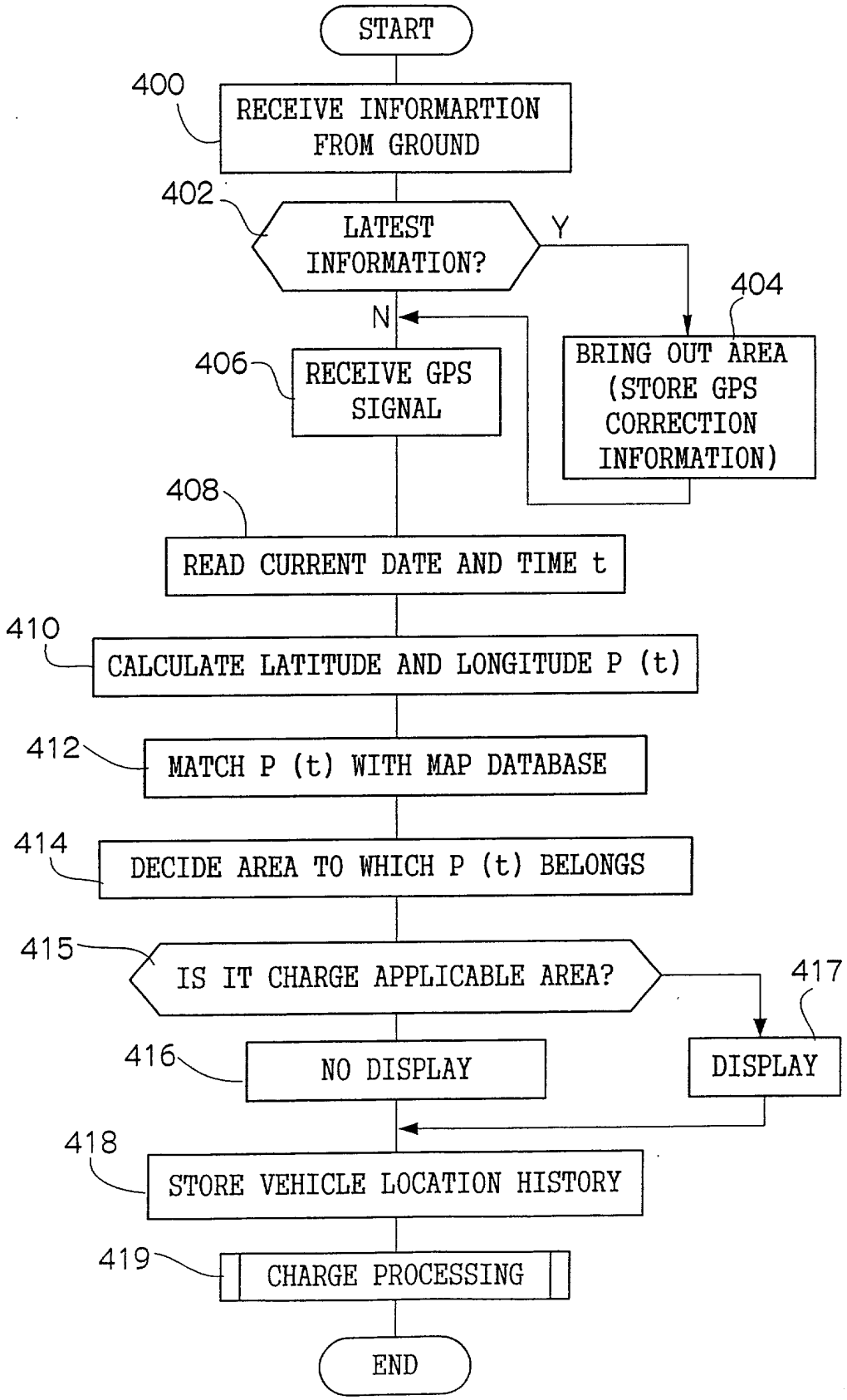
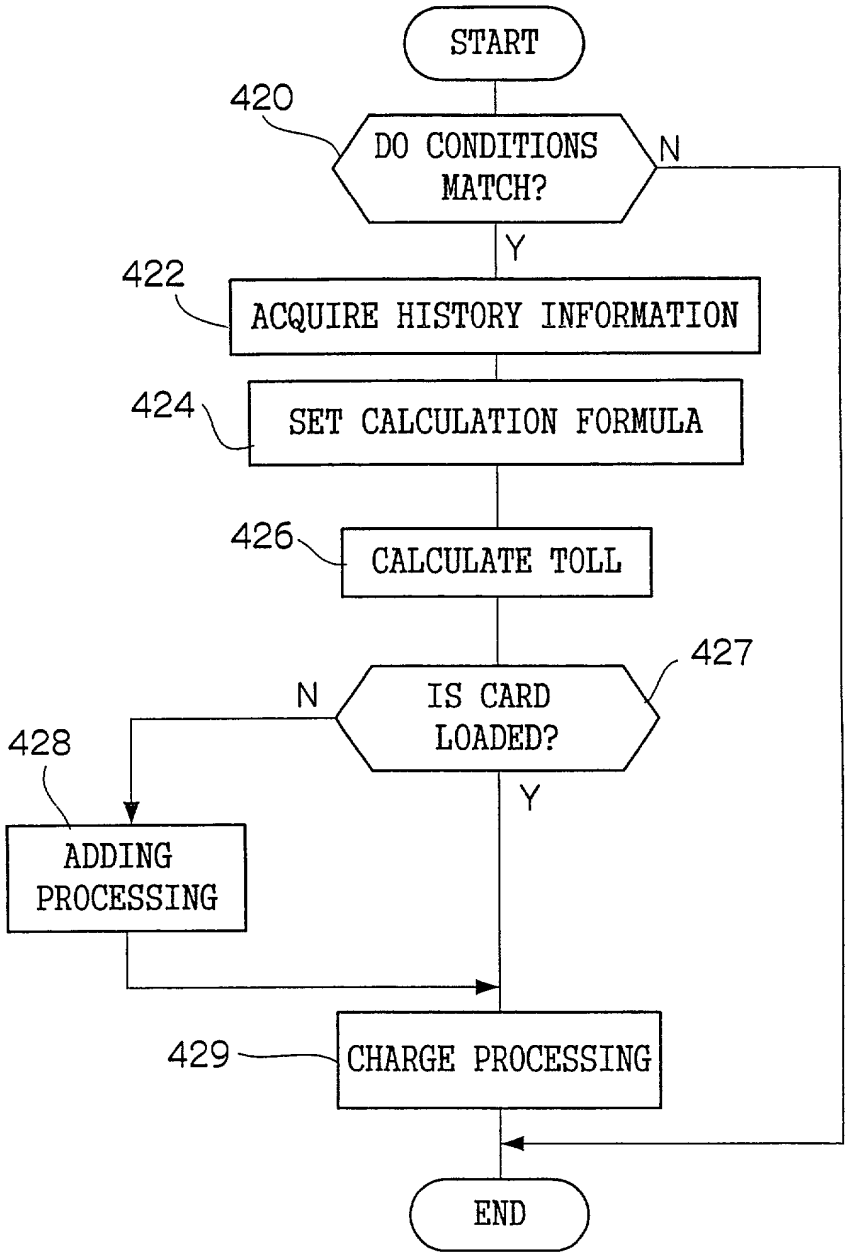
FIG. 6


START
400
RECEIVE INFORMARTION FROM GROUND
402
LATEST INFORMATION?
Y
N
404
BRING OUT AREA (STORE GPS CORRECTION INFORMATION)
406
RECEIVE GPS SIGNAL
408
READ CURRENT DATE AND TIME t
410
CALCULATE LATITUDE AND LONGITUDE P (t)
412
MATCH P (t) WITH MAP DATABASE
414
DECIDE AREA TO WHICH P (t) BELONGS
415
IS IT CHARGE APPLICABLE AREA?
417
DISPLAY
416
NO DISPLAY
418
STORE VEHICLE LOCATION HISTORY
419
CHARGE PROCESSING
END

F I G. 7



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F I G. 8

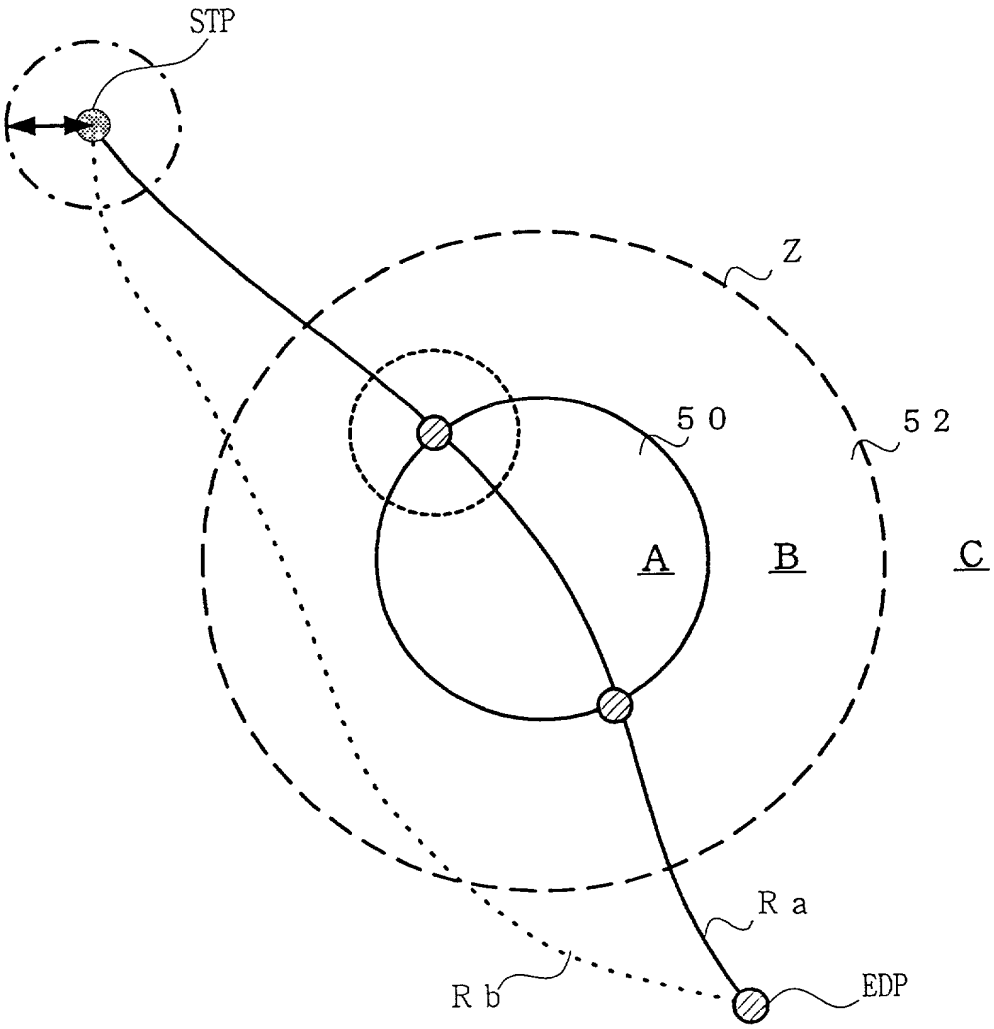

FIG. 9

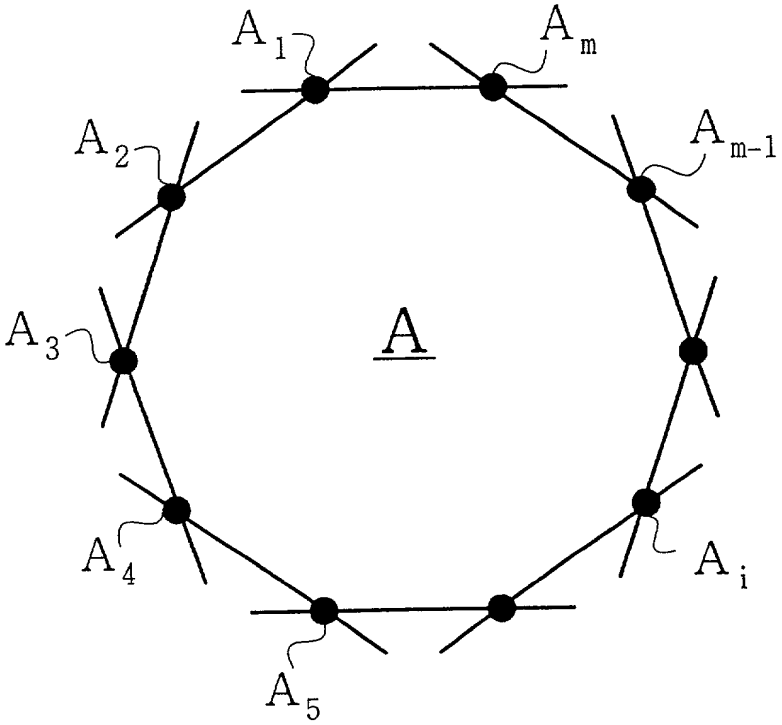

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FIG. 10

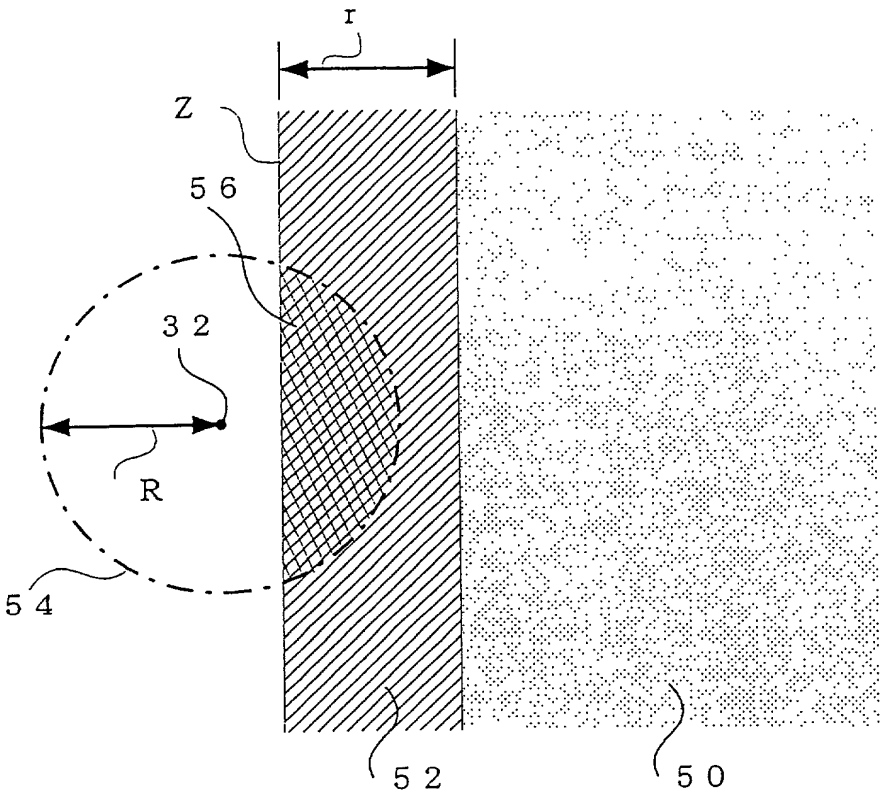

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FIG. 11 A

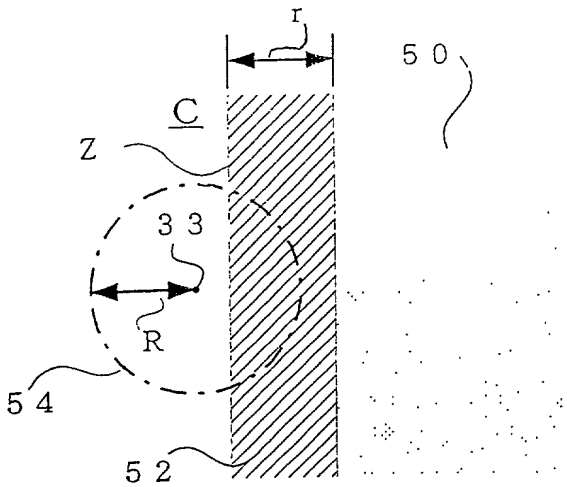


FIG. 11 B

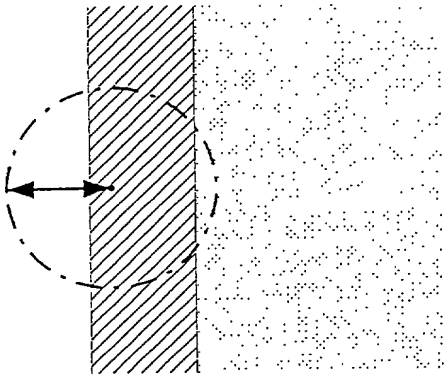


FIG. 11 C

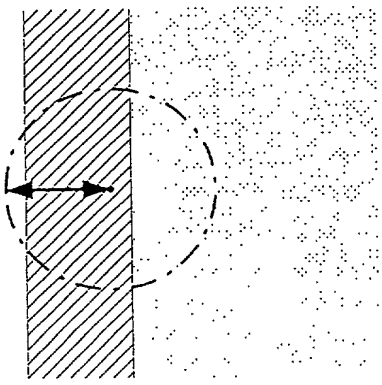


FIG. 11 D

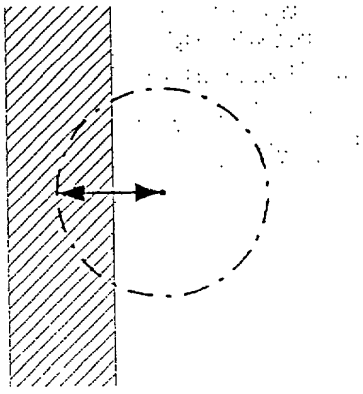


FIG. 12

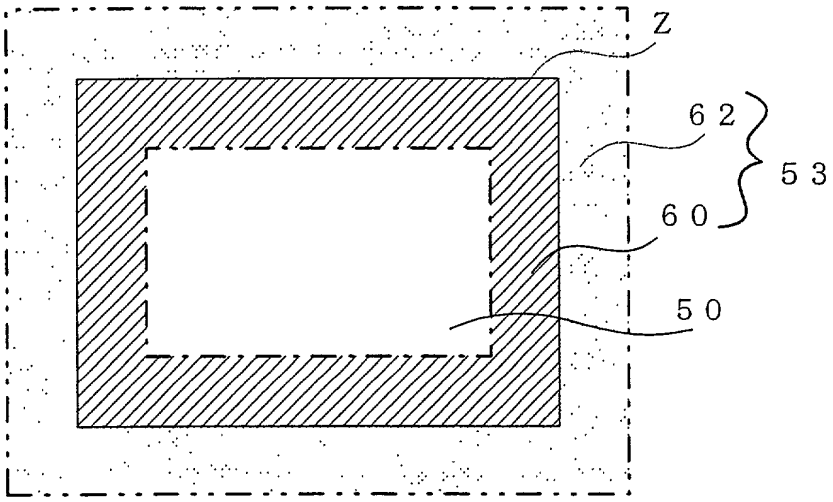

Z
62
53
60
50

FIG. 13

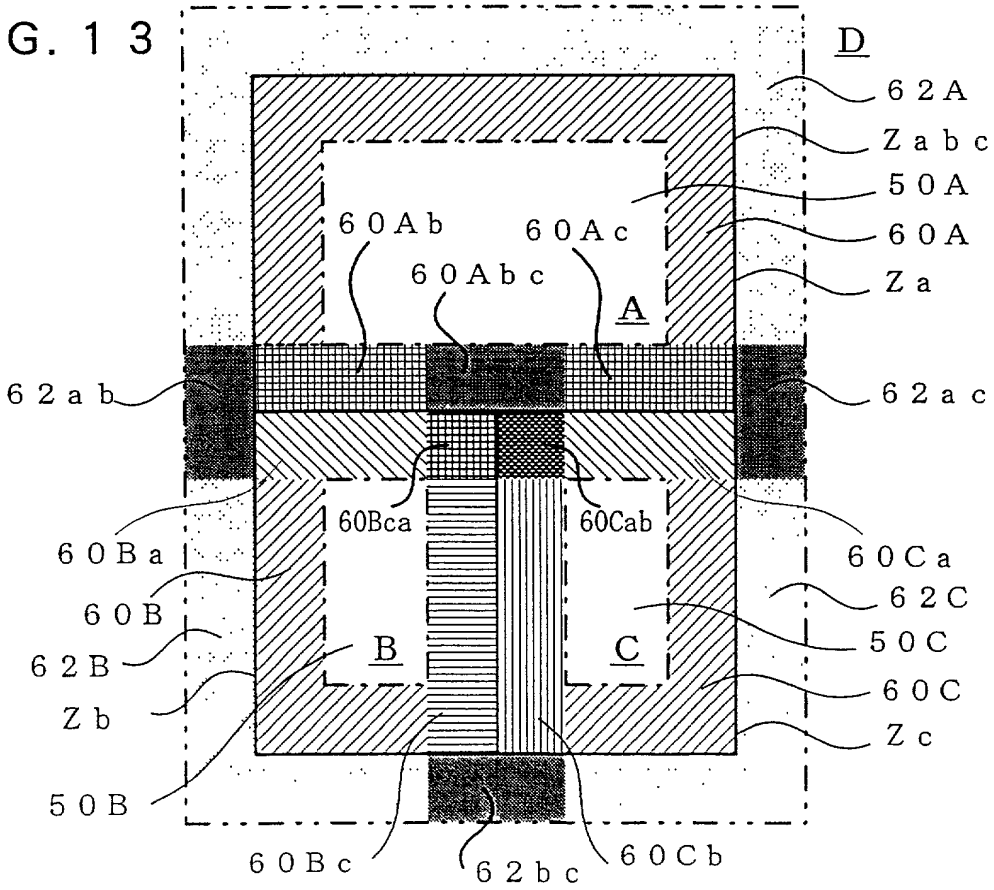

D
62A
Zabc
50A
60A
Za
60Ab
60Ac
60Abc
A
62ab
62ac
60Bca
60Cab
60Ba
60Ca
62C
60B
50C
62B
B
C
60C
Zb
Zc
50B
60Bc
62bc
60Cb

FIG. 14

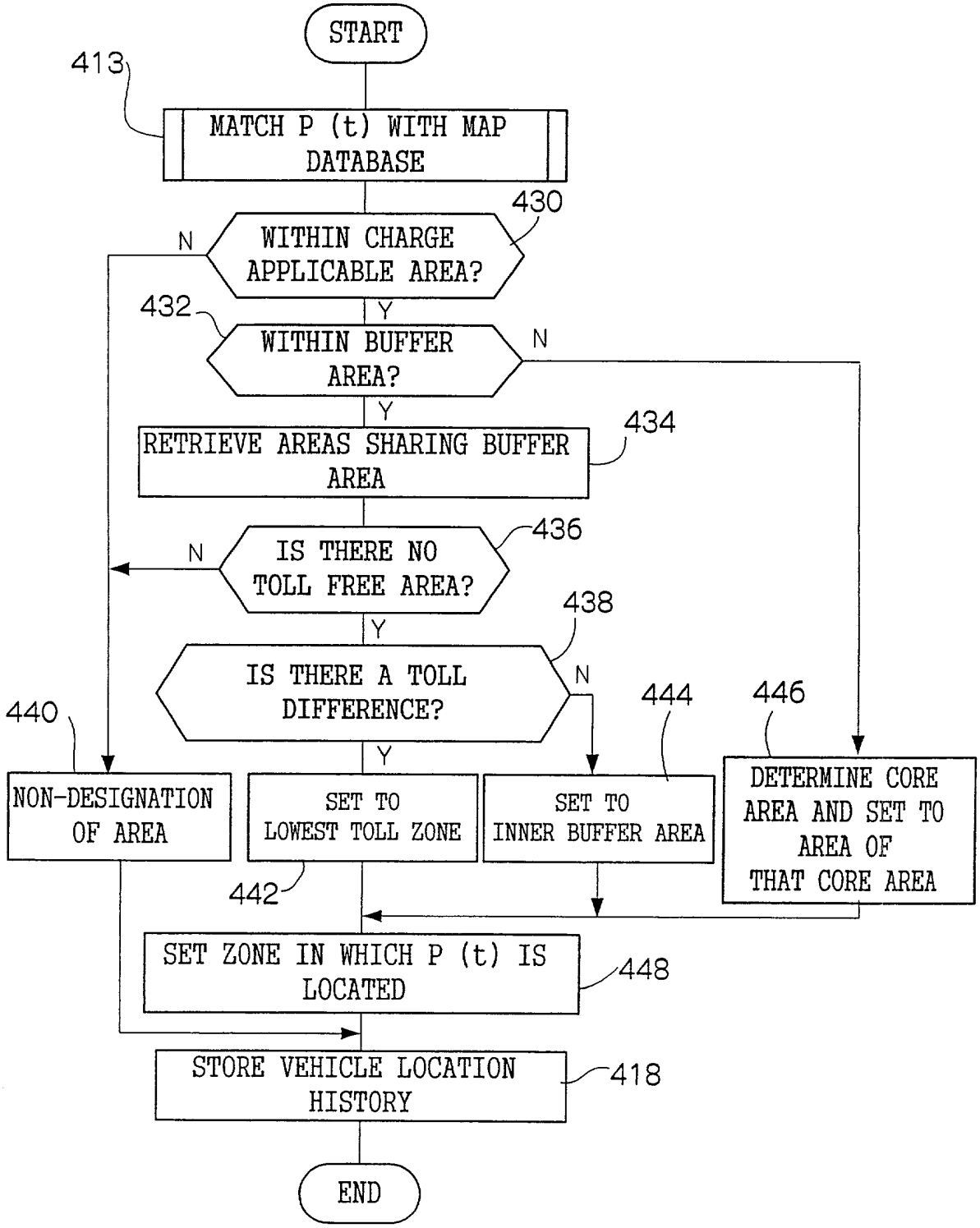

START
413
MATCH P (t) WITH MAP DATABASE
430
WITHIN CHARGE APPLICABLE AREA?
N
Y
432
WITHIN BUFFER AREA?
N
Y
RETRIEVE AREAS SHARING BUFFER AREA
434
IS THERE NO TOLL FREE AREA?
436
N
Y
438
IS THERE A TOLL DIFFERENCE?
N
Y
440
444
446
NON-DESIGNATION OF AREA
SET TO LOWEST TOLL ZONE
SET TO INNER BUFFER AREA
DETERMINE CORE AREA AND SET TO AREA OF THAT CORE AREA
442
SET ZONE IN WHICH P (t) IS LOCATED
448
STORE VEHICLE LOCATION HISTORY
418
END

FIG. 15

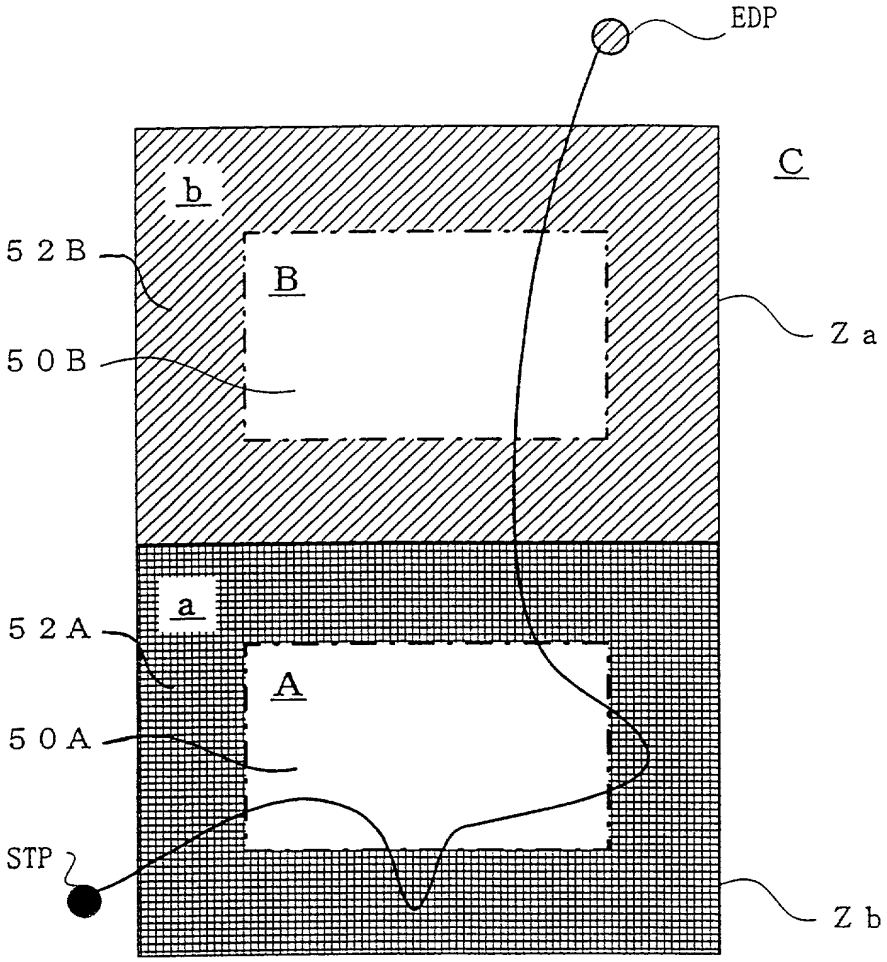
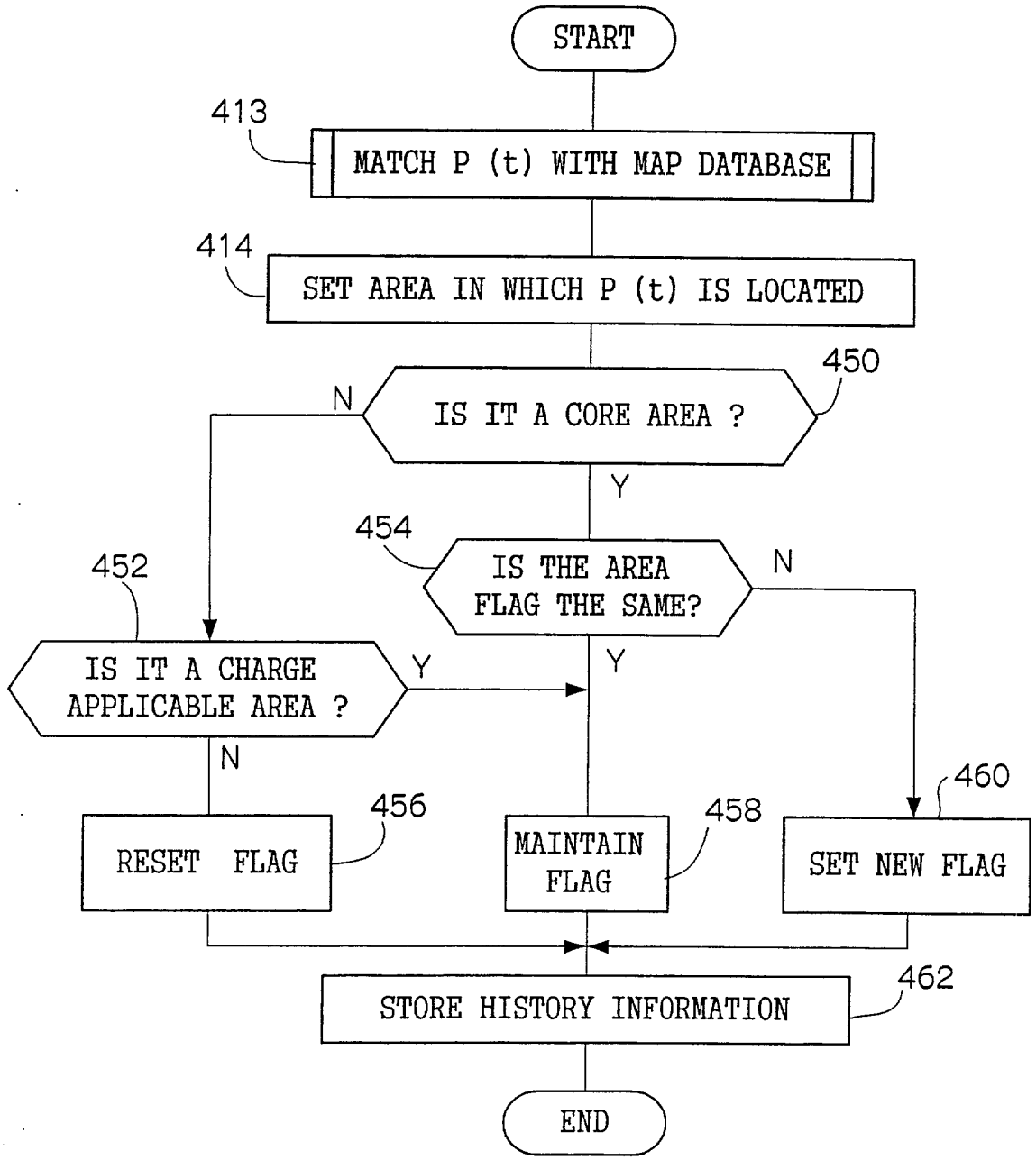


FIG. 16


START
413
MATCH P (t) WITH MAP DATABASE
414
SET AREA IN WHICH P (t) IS LOCATED
450
IS IT A CORE AREA ?
N
Y
454
IS THE AREA FLAG THE SAME?
N
Y
452
IS IT A CHARGE APPLICABLE AREA ?
Y
N
456
RESET FLAG
458
MAINTAIN FLAG
460
SET NEW FLAG
462
STORE HISTORY INFORMATION
END

F I G. 1 7 A

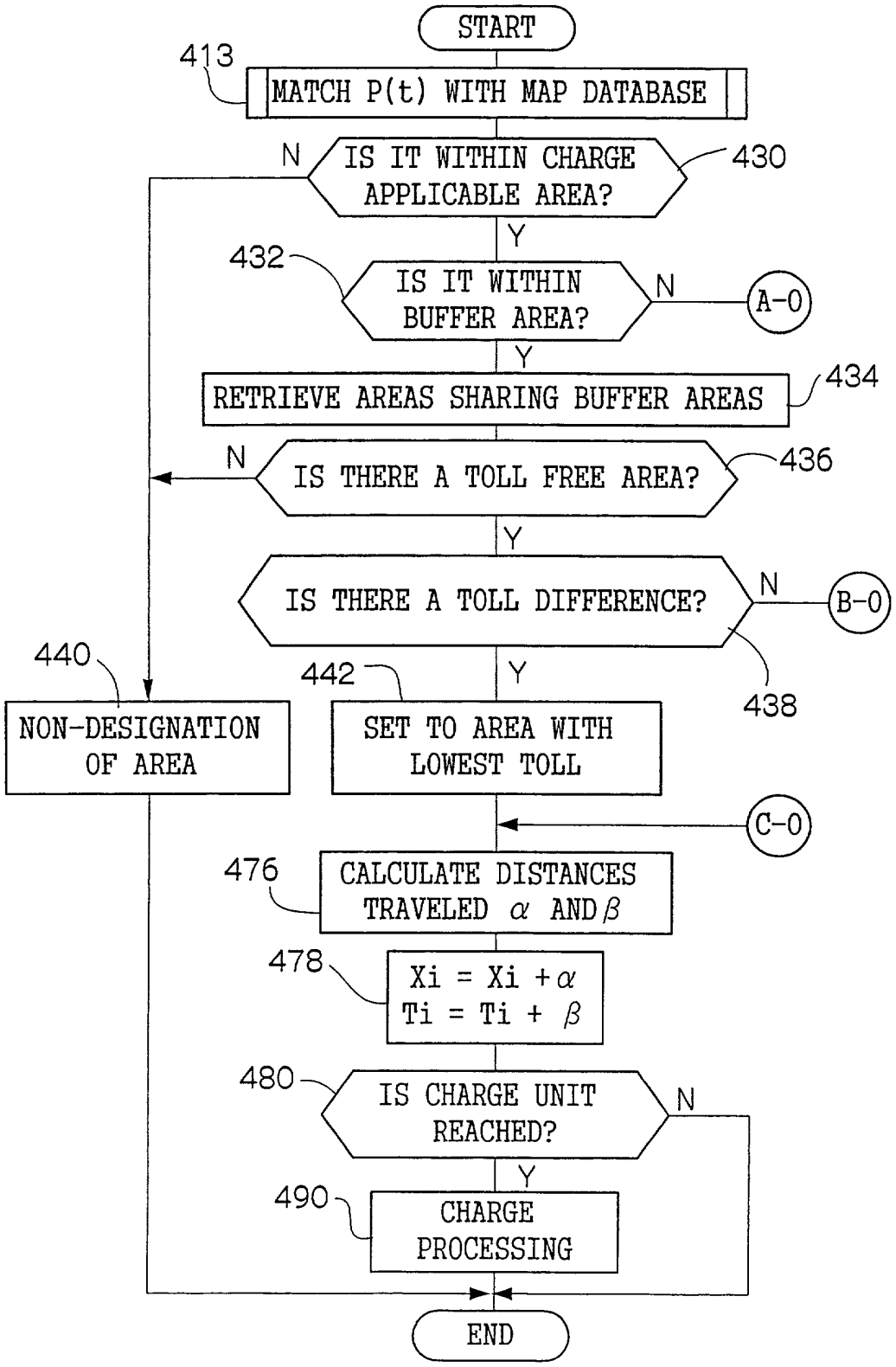


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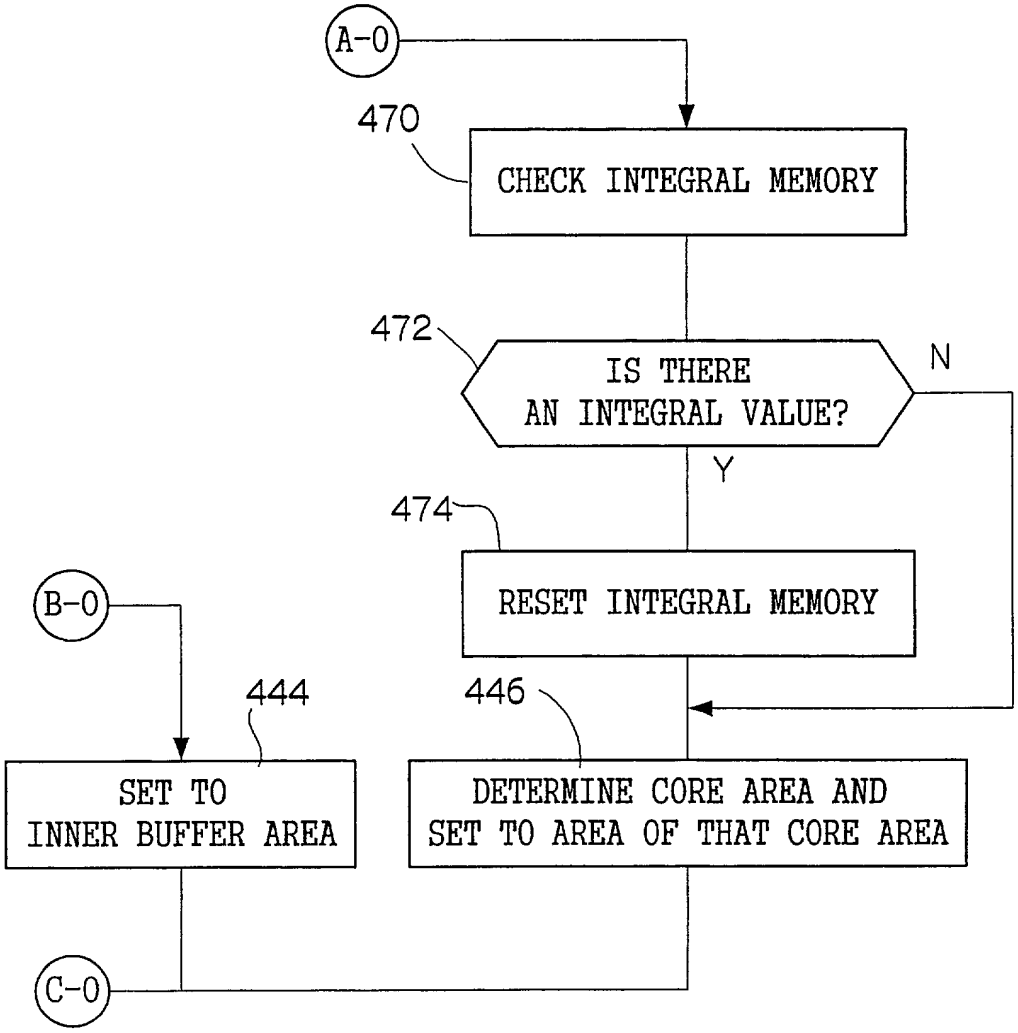
FIG. 17B



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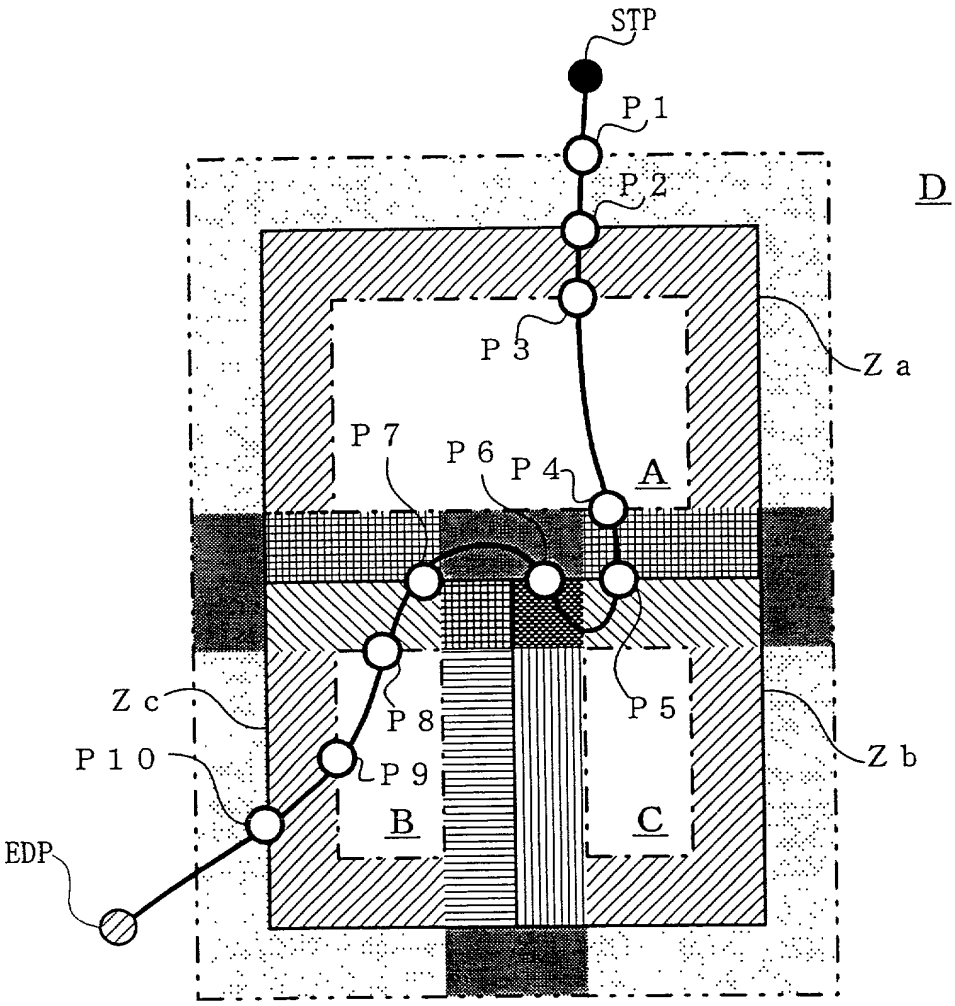
F I G. 1 8



FP05-0360-00/2005-10-04

FIG. 19

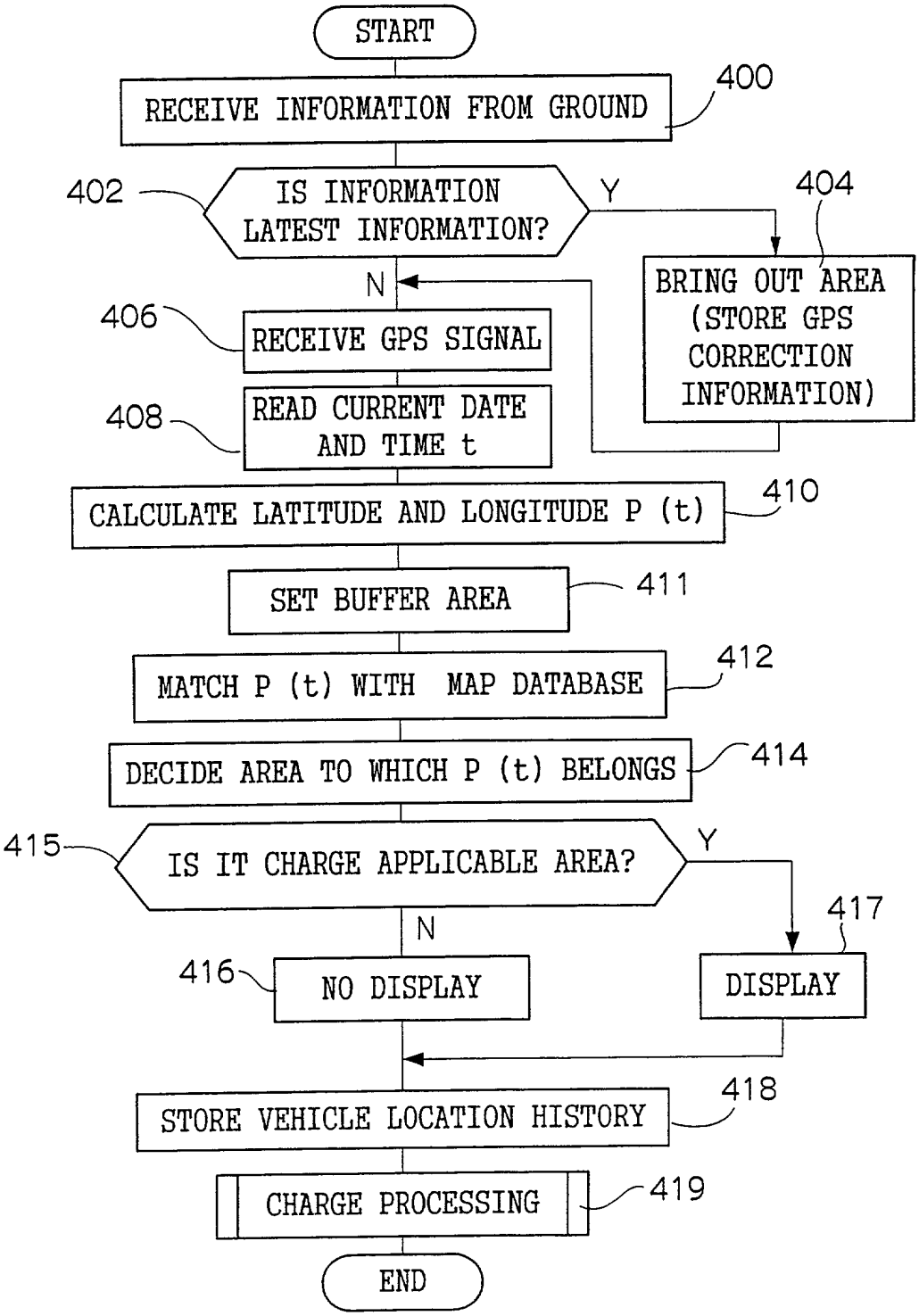


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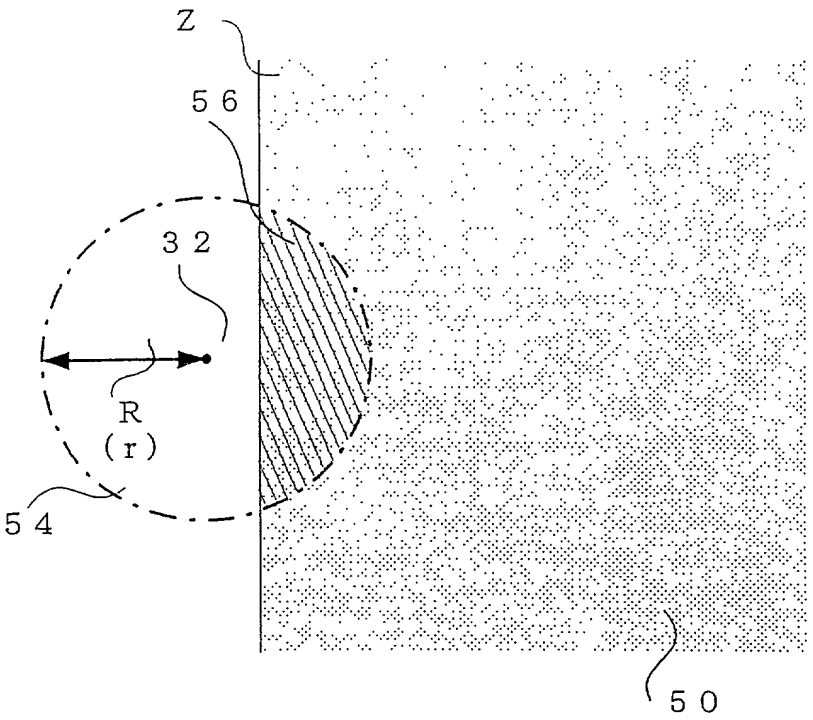
FIG. 20



JP2020-526760

FIG. 21A

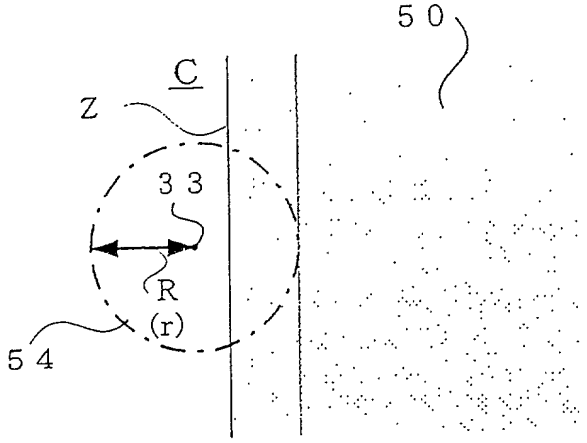


FIG. 21B

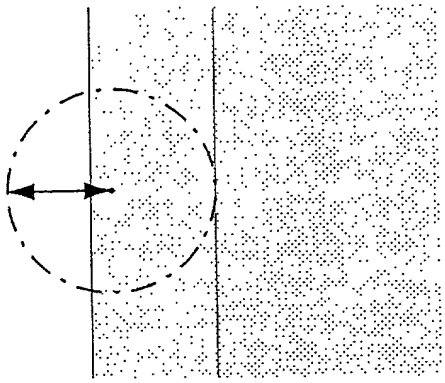


FIG. 21C

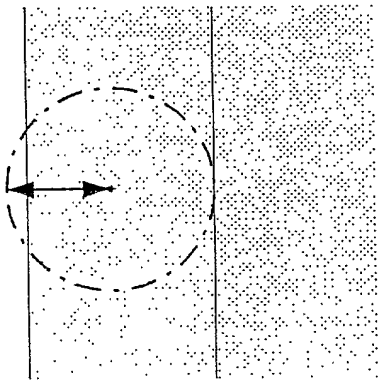


FIG. 21D

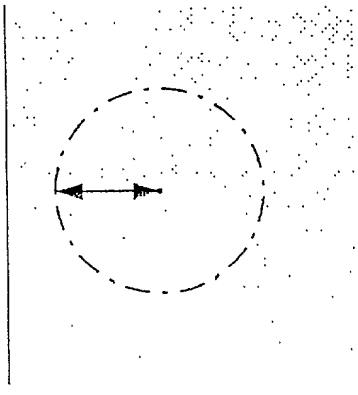


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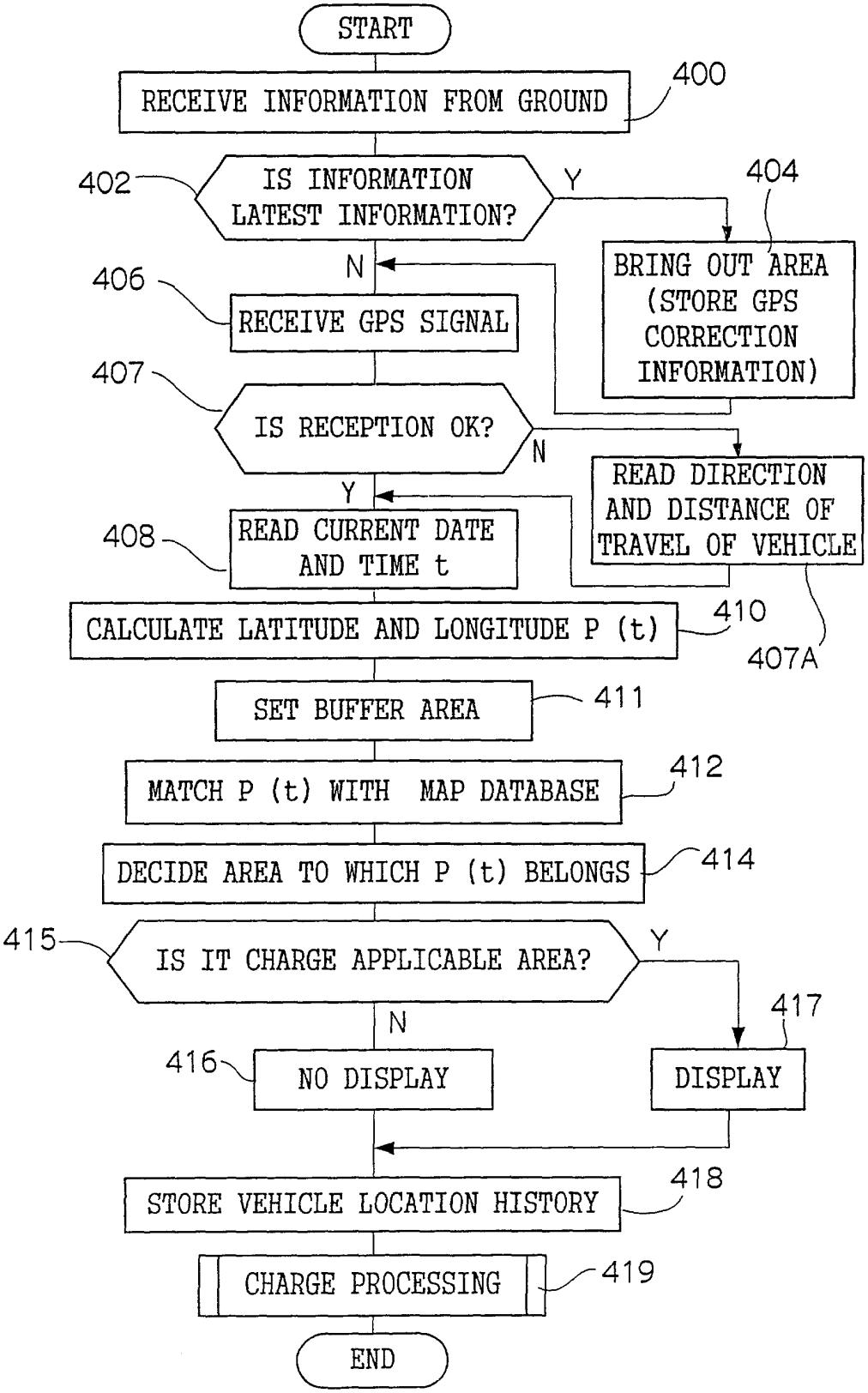
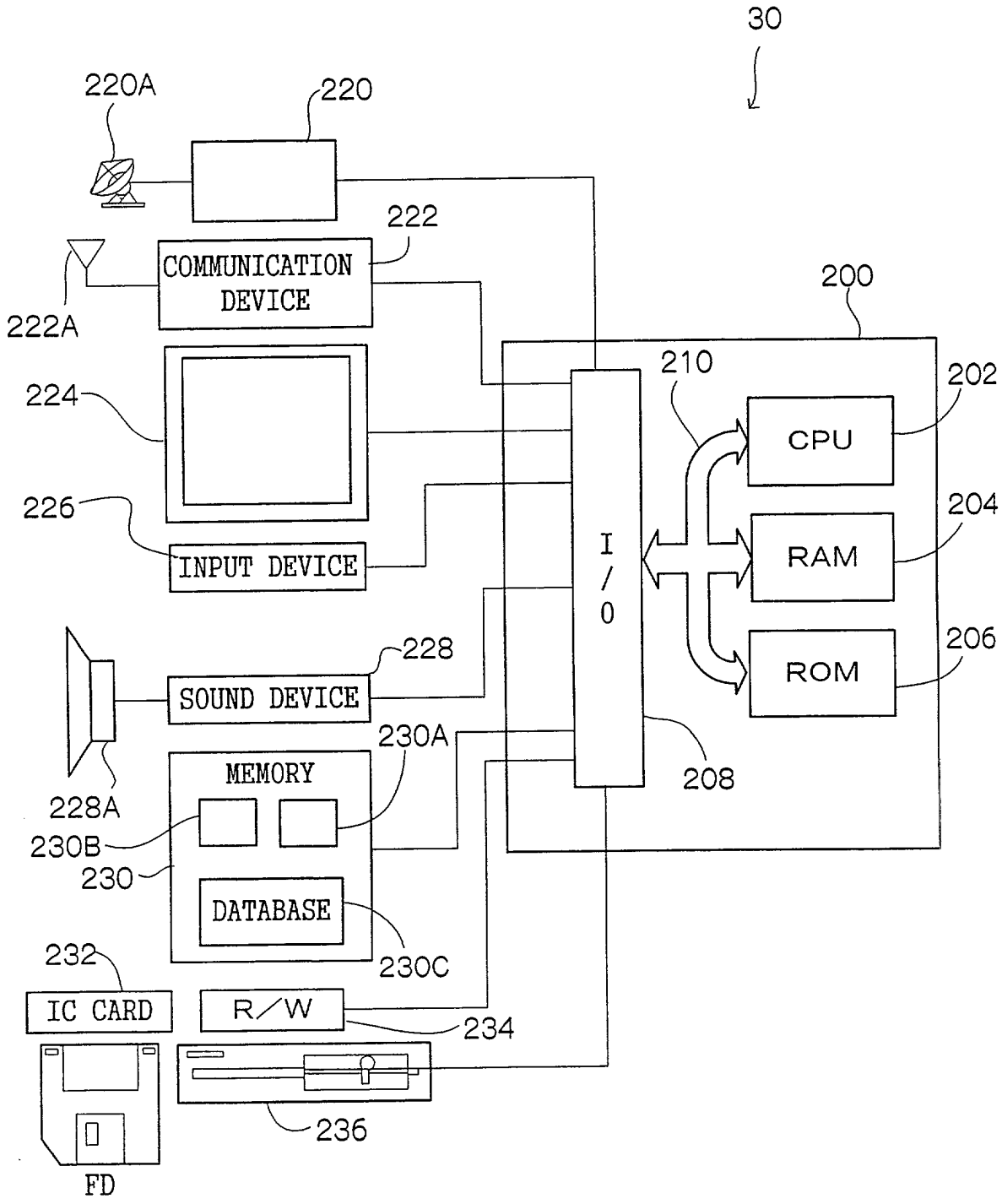
FIG. 22


START
RECEIVE INFORMATION FROM GROUND
400
IS INFORMATION LATEST INFORMATION?
402
Y
404
BRING OUT AREA (STORE GPS CORRECTION INFORMATION)
N
406
RECEIVE GPS SIGNAL
407
IS RECEPTION OK?
N
READ DIRECTION AND DISTANCE OF TRAVEL OF VEHICLE
Y
408
READ CURRENT DATE AND TIME t
CALCULATE LATITUDE AND LONGITUDE P (t)
410
407A
SET BUFFER AREA
411
MATCH P (t) WITH MAP DATABASE
412
DECIDE AREA TO WHICH P (t) BELONGS
414
415
IS IT CHARGE APPLICABLE AREA?
Y
417
N
416
NO DISPLAY
DISPLAY
STORE VEHICLE LOCATION HISTORY
418
CHARGE PROCESSING
419
END

F I G. 2 3



1 0 0 2 2 7 3 6 5 0 2 0 0 1

FIG. 24

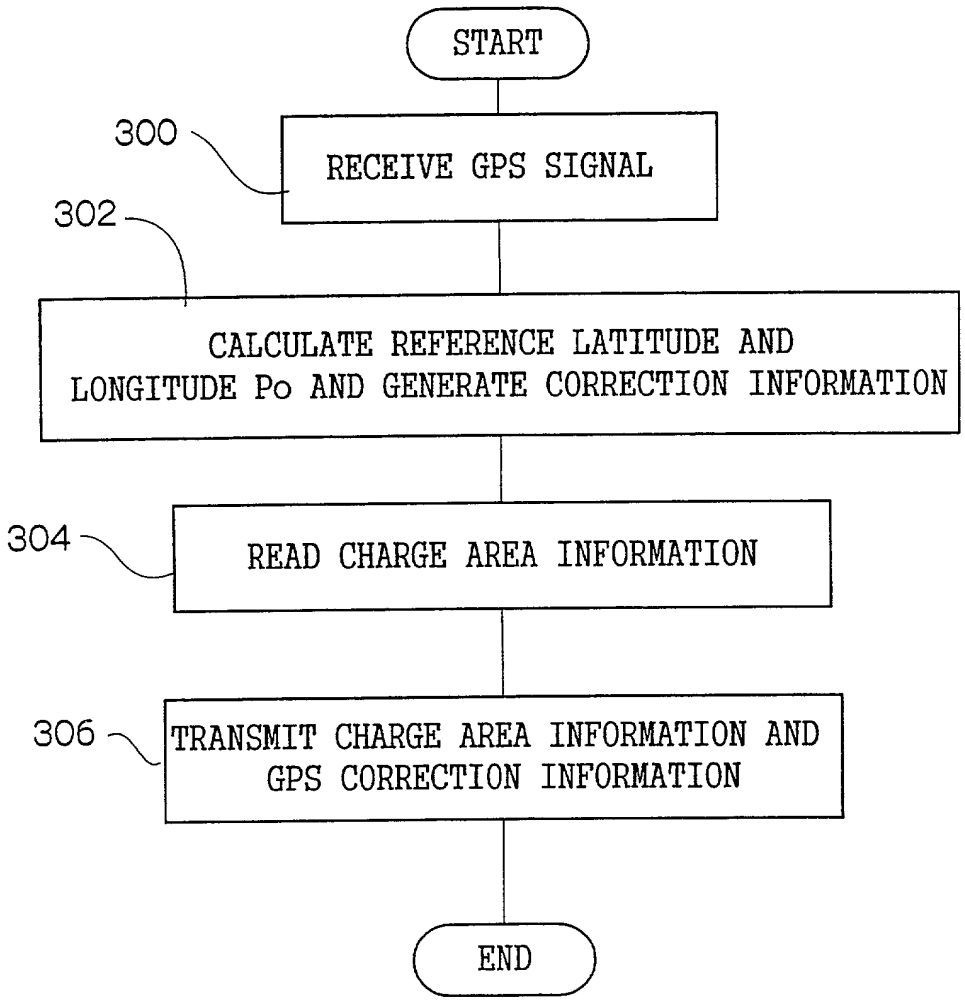

START
300
RECEIVE GPS SIGNAL
302
CALCULATE REFERENCE LATITUDE AND LONGITUDE Po AND GENERATE CORRECTION INFORMATION
304
READ CHARGE AREA INFORMATION
306
TRANSMIT CHARGE AREA INFORMATION AND GPS CORRECTION INFORMATION
END

FIG. 25

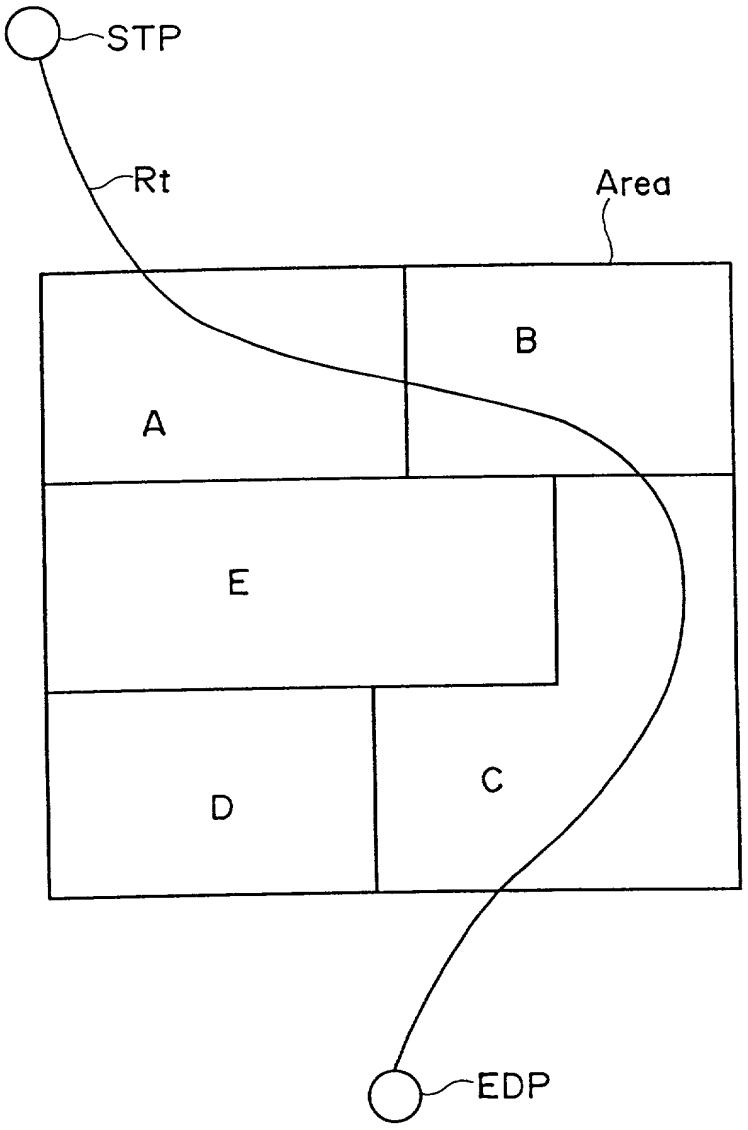
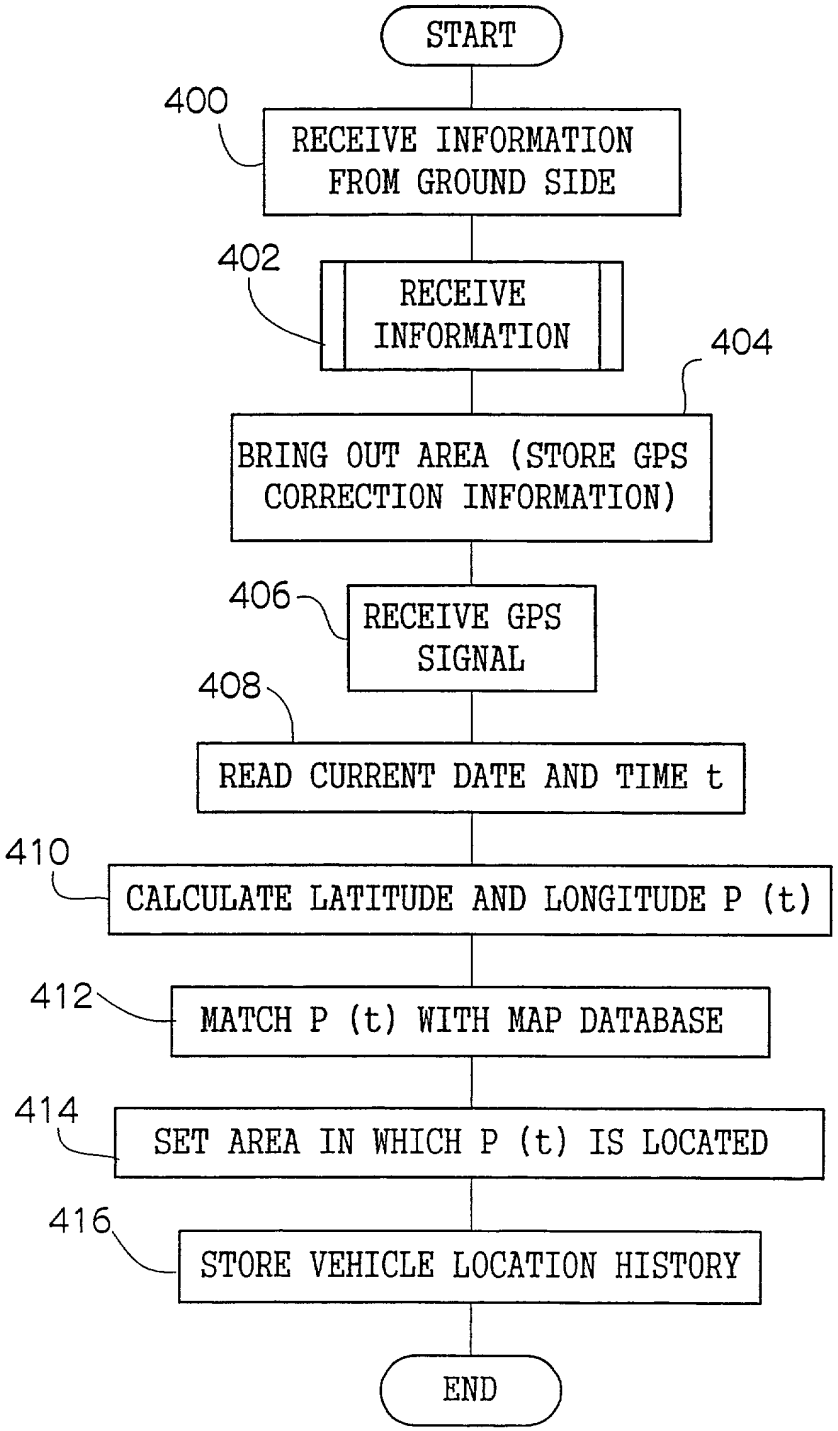
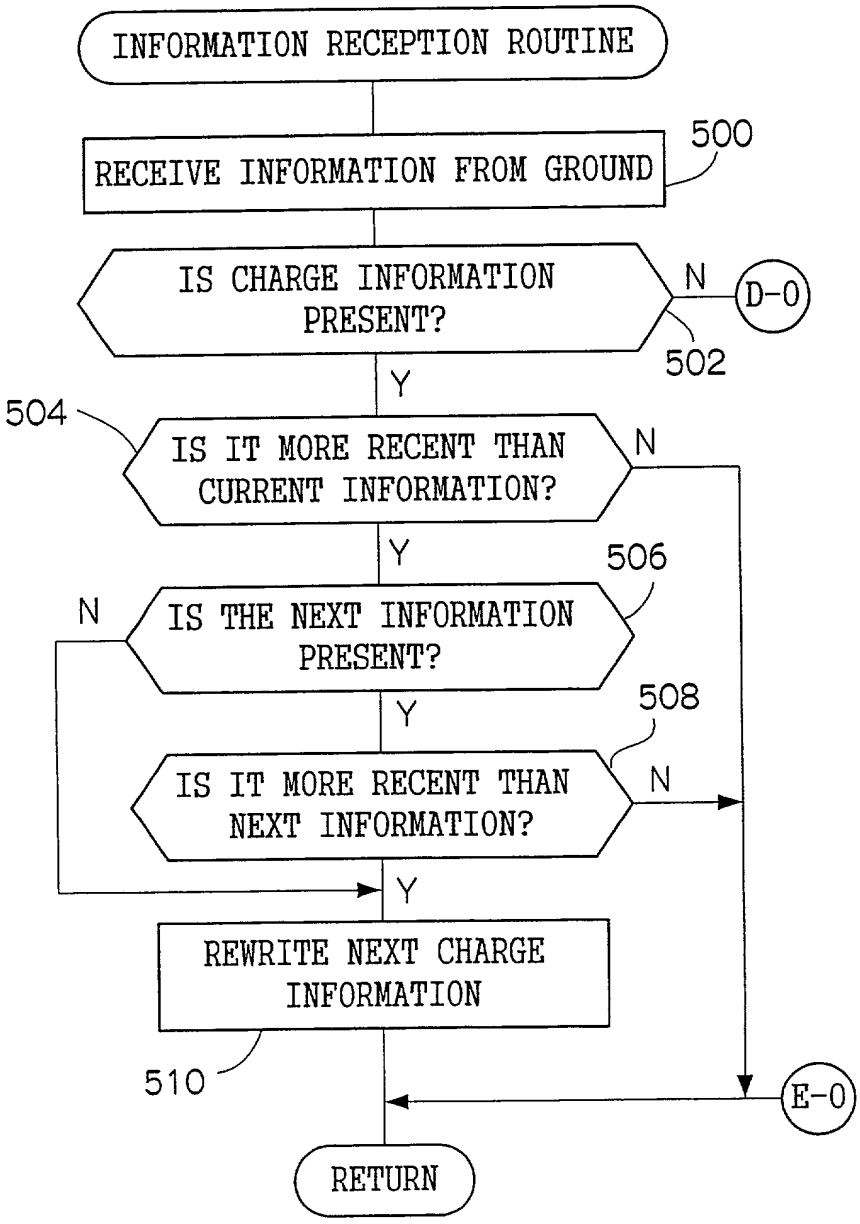


FIG. 26



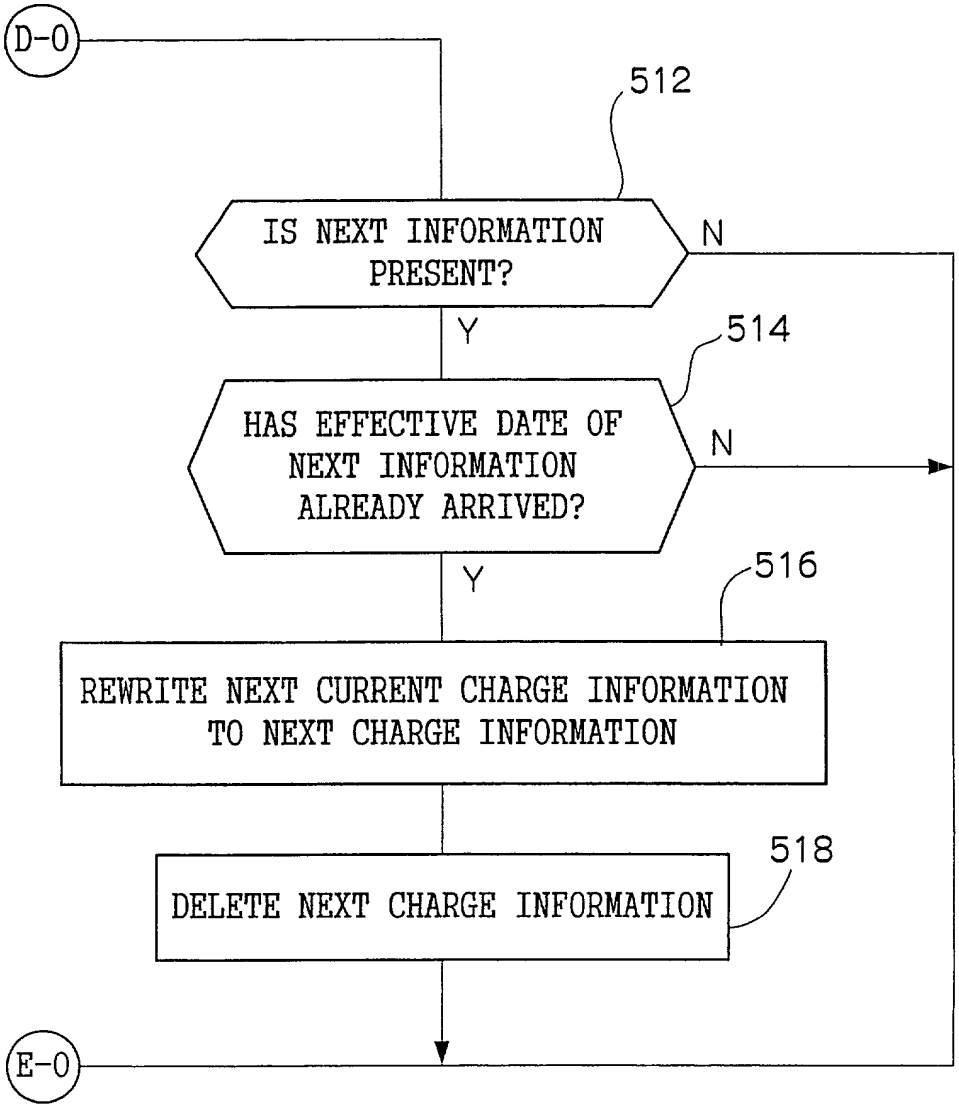
FOR OFFICIAL USE ONLY

FIG. 27 A



FOREIGN-2005-0

FIG. 27 B



FOREIGN PATENT

FIG. 28

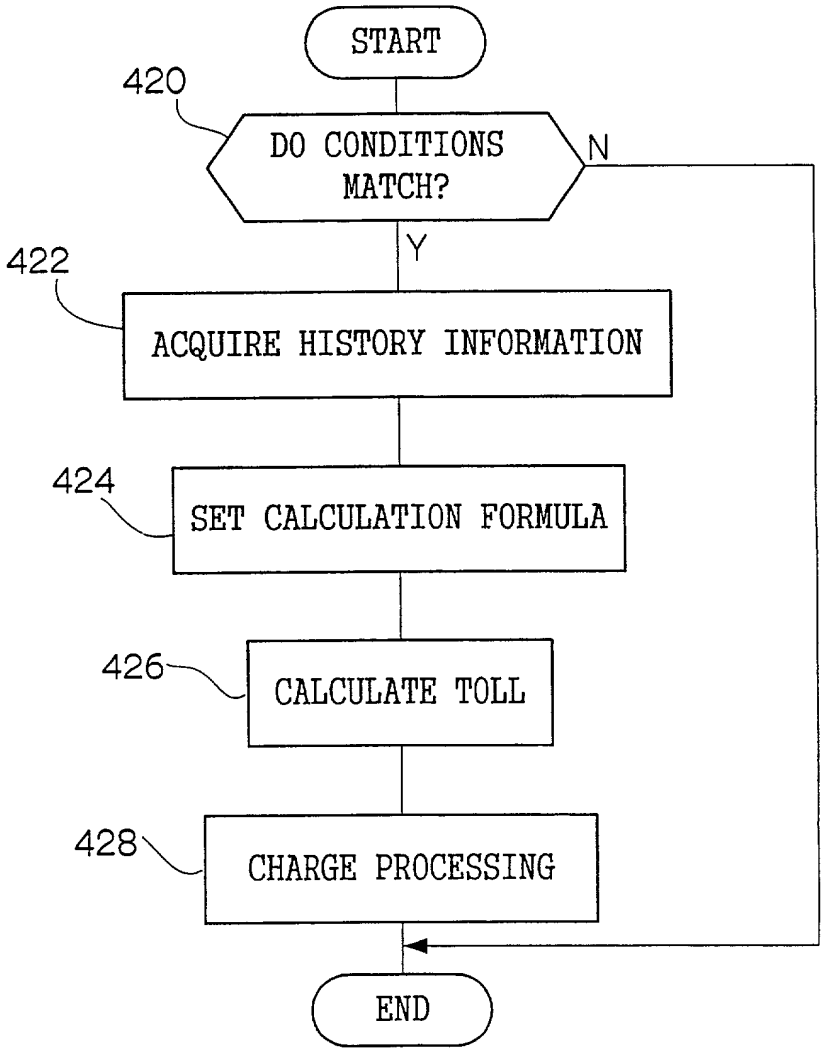


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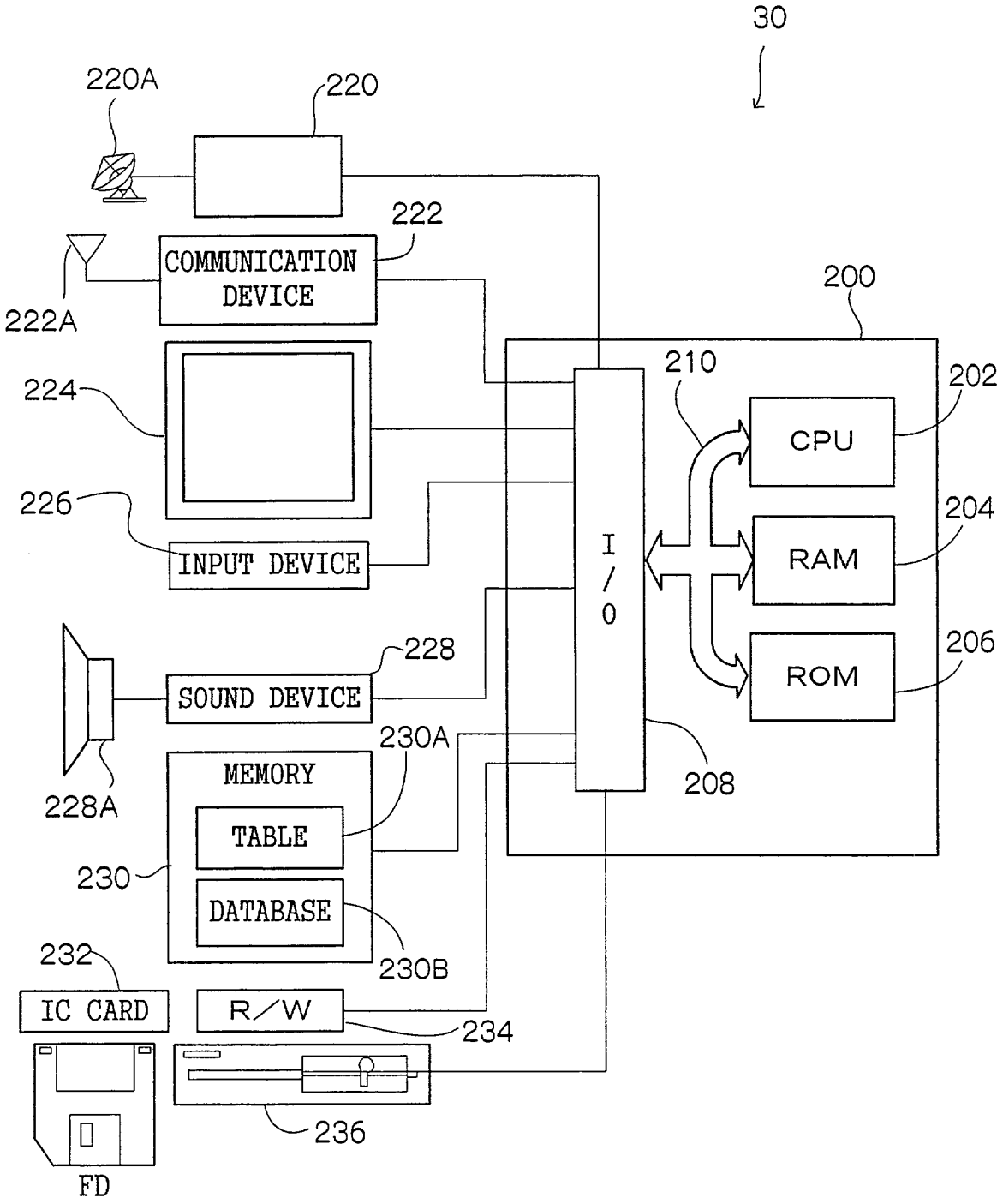
FIG. 29



FOR OFFICIAL USE ONLY

F I G. 3 0

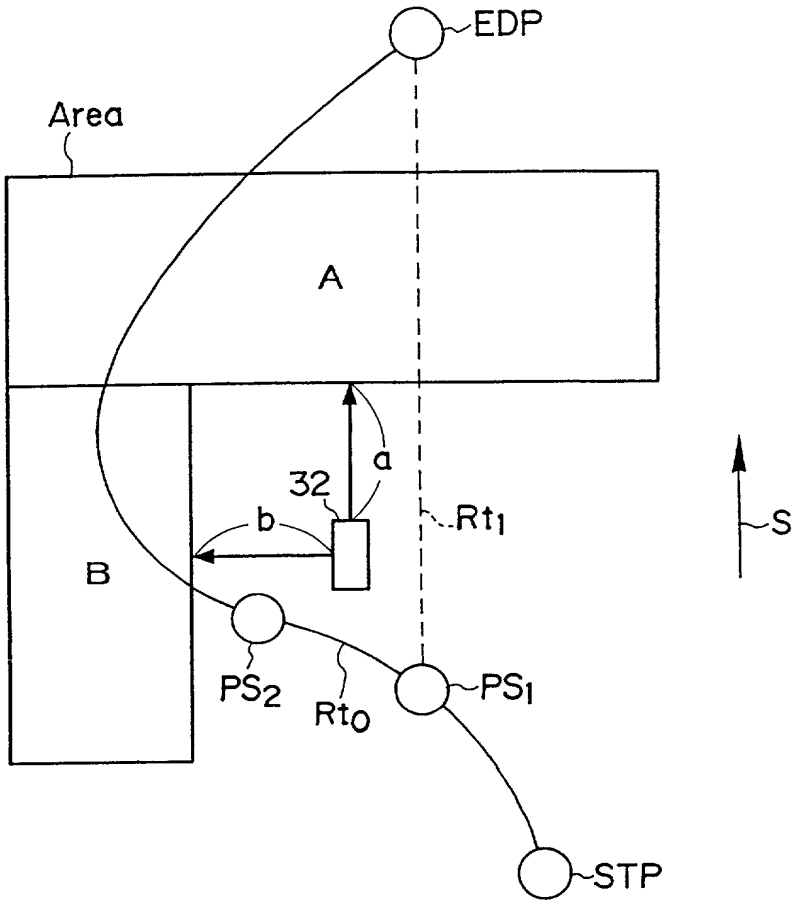
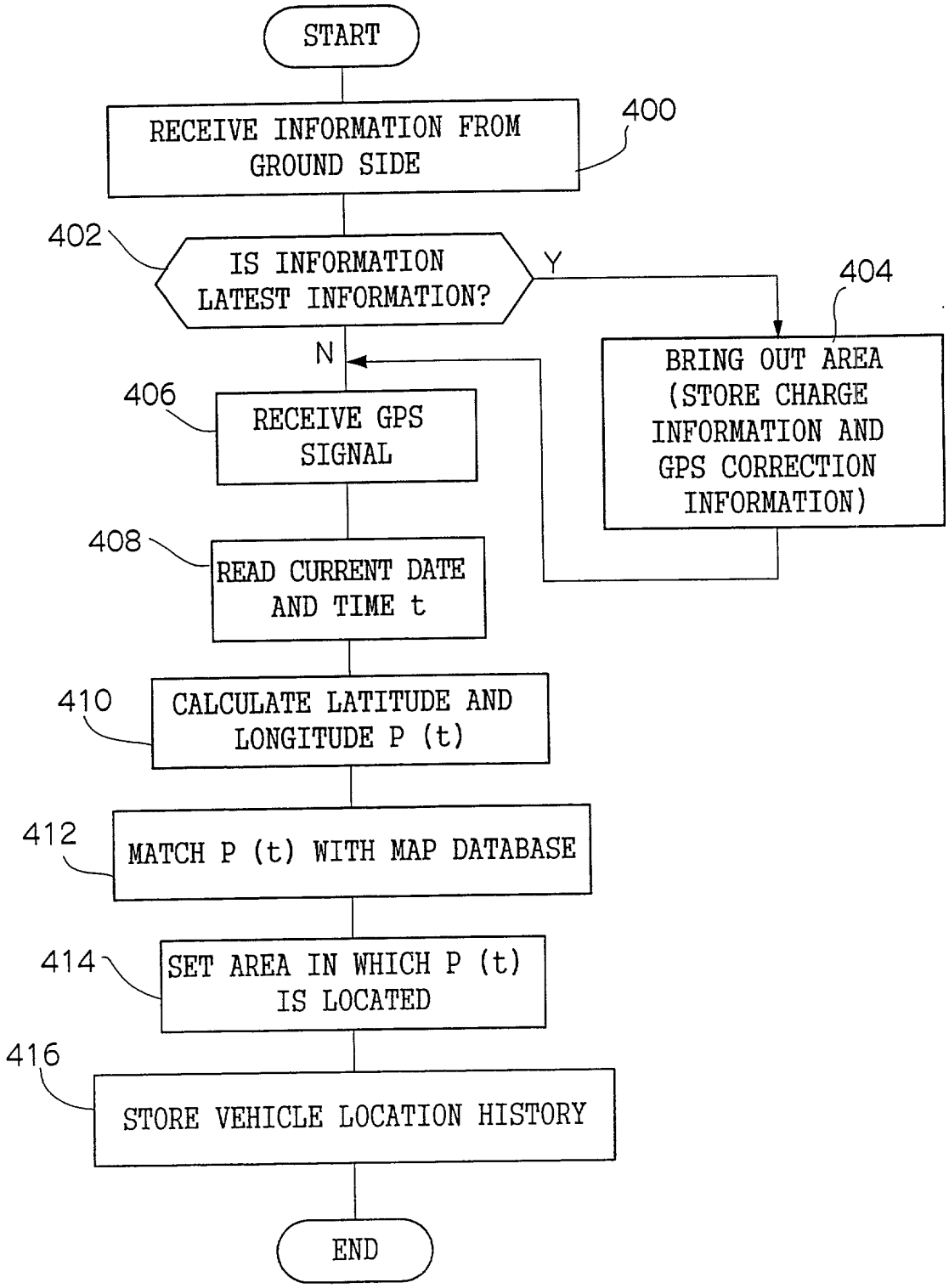


FIG. 31



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JP06250723A

FIG. 32

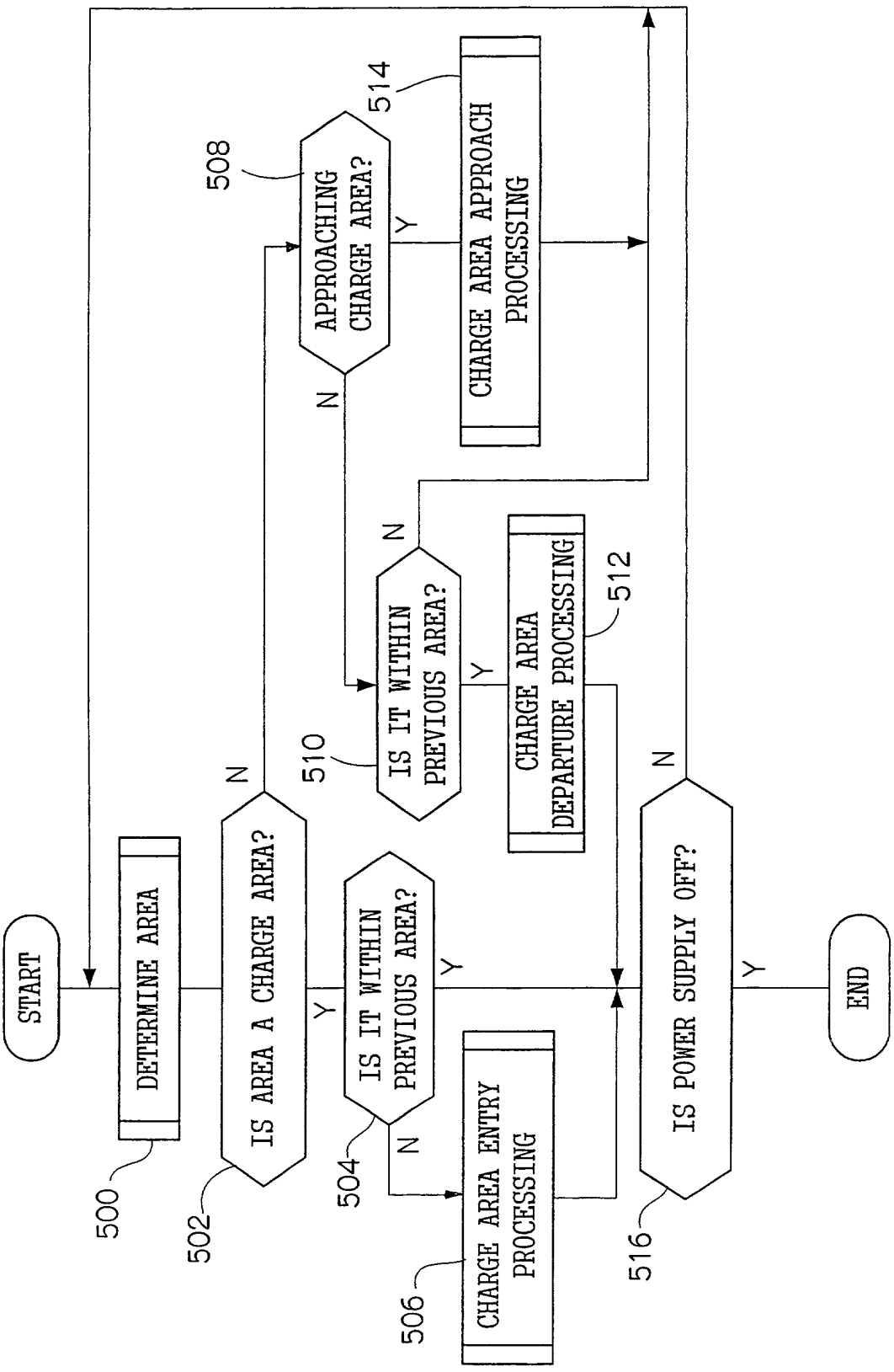

FIG. 33A

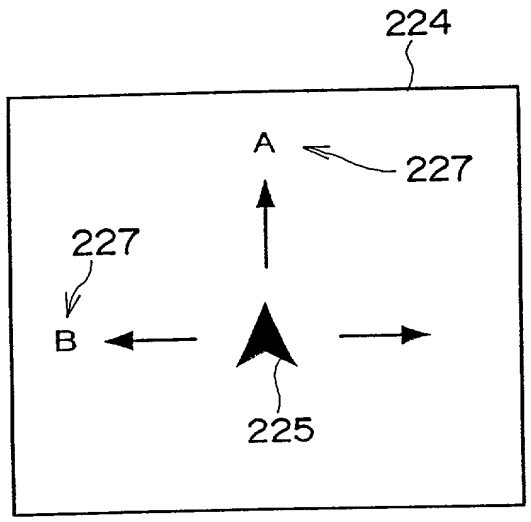

FIG. 33B

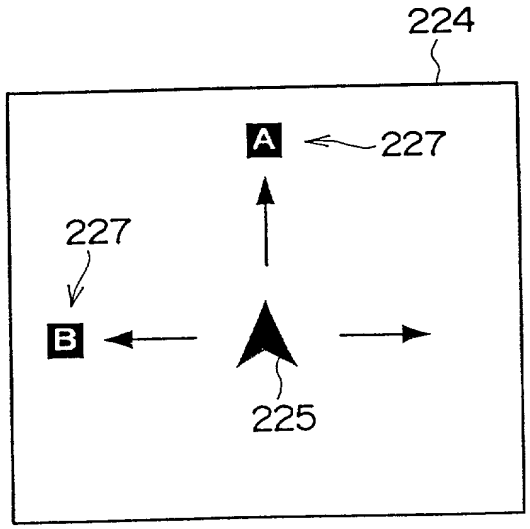

FIG. 34

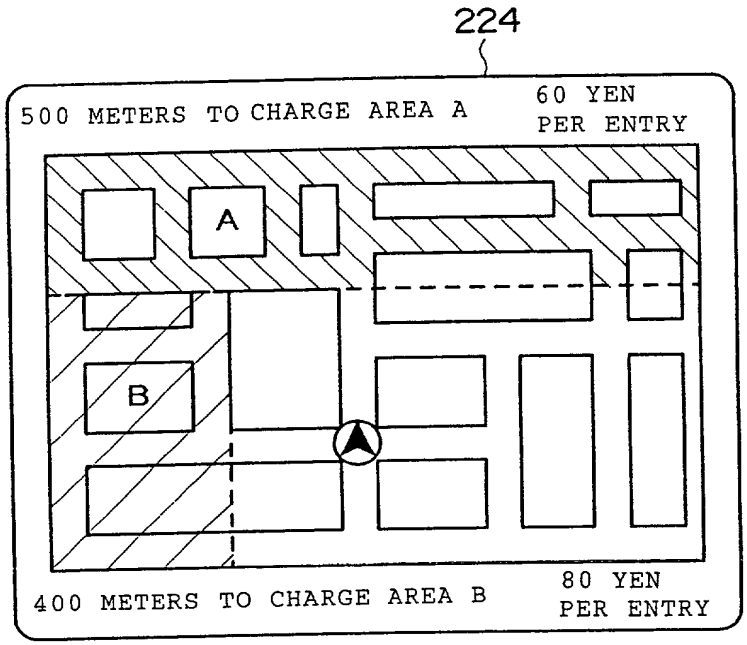

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FIG. 35

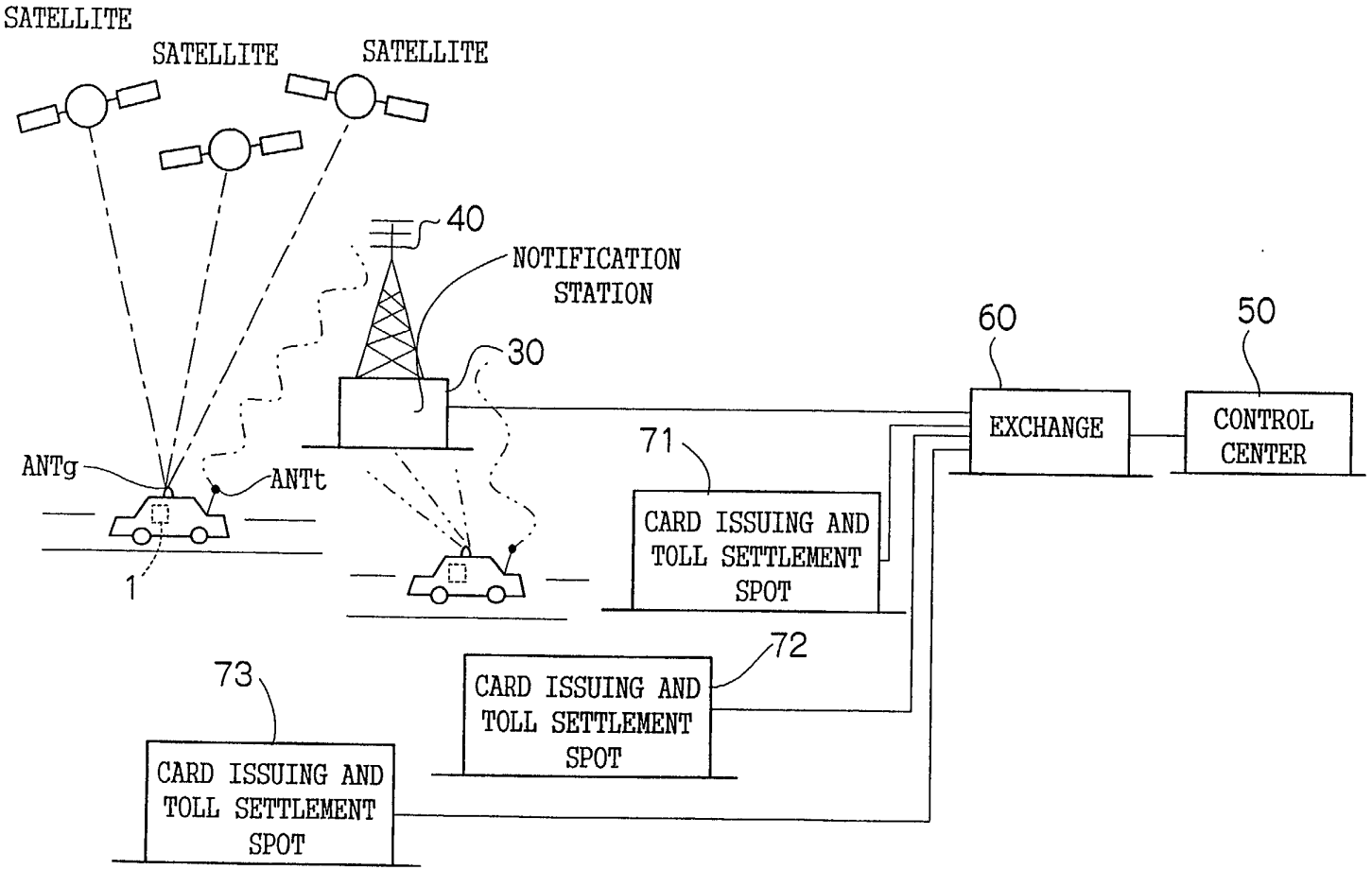
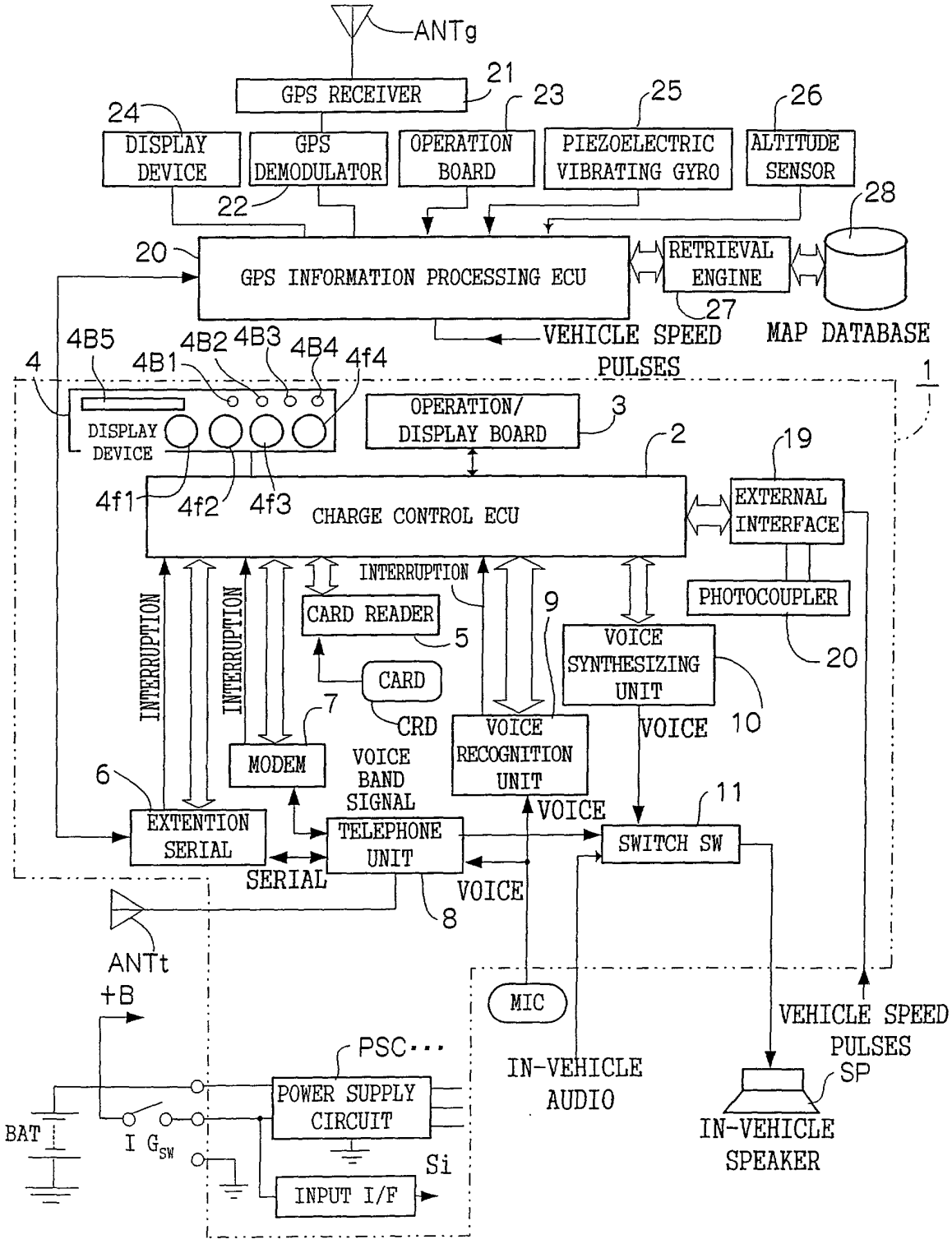
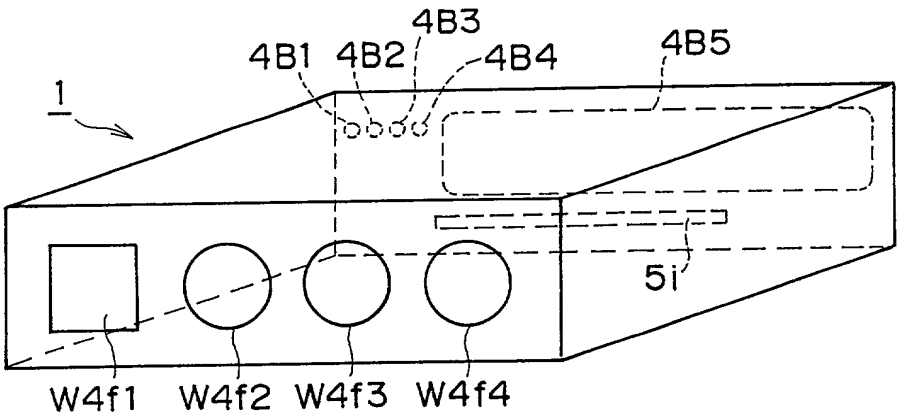

SATELLITE
SATELLITE
SATELLITE
40
NOTIFICATION STATION
30
60
50
EXCHANGE
CONTROL CENTER
71
CARD ISSUING AND TOLL SETTLEMENT SPOT
ANTg
ANTt
1
72
CARD ISSUING AND TOLL SETTLEMENT SPOT
73
CARD ISSUING AND TOLL SETTLEMENT SPOT

FIG. 36

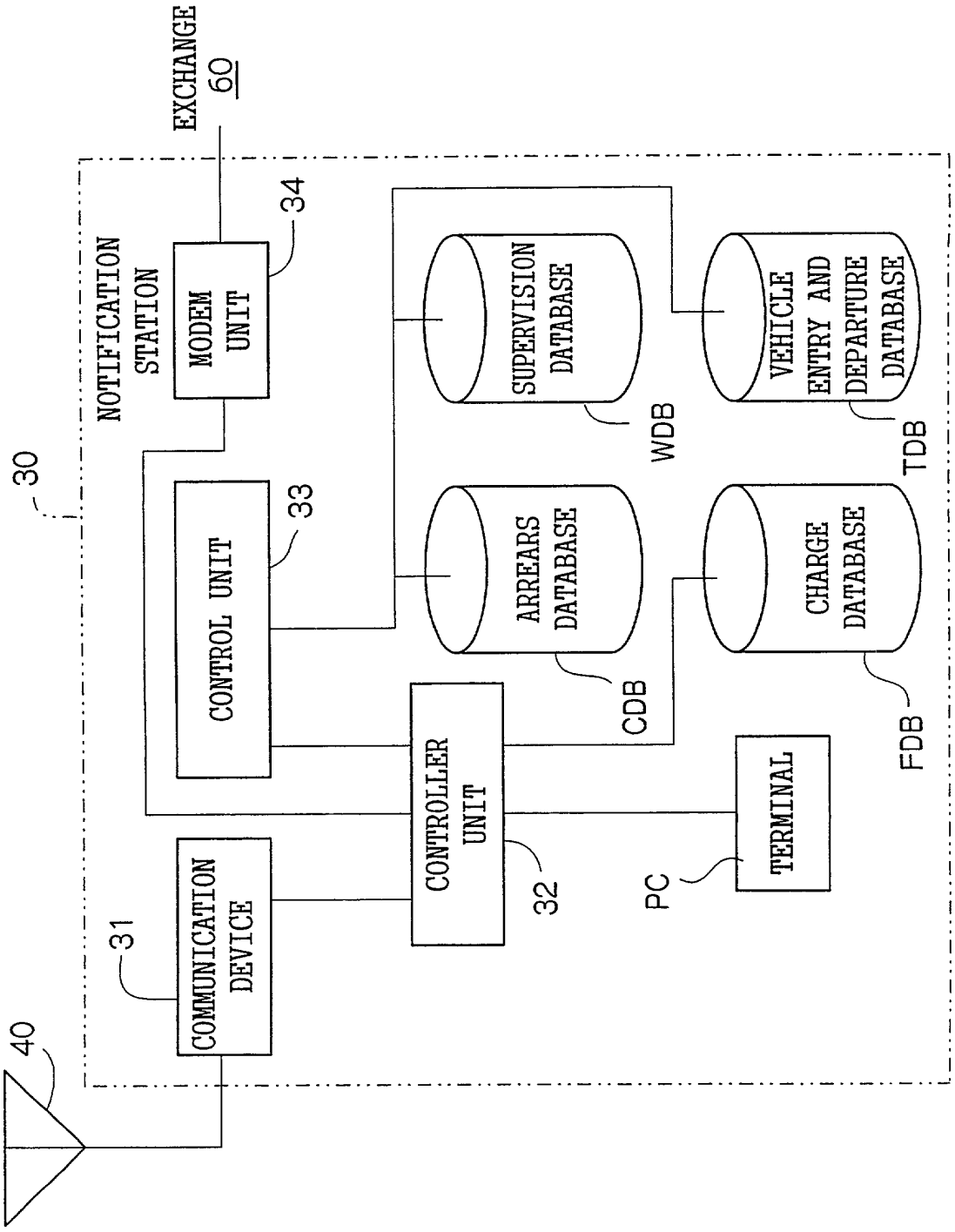

ANTg
GPS RECEIVER
21
23
25
26
24
DISPLAY DEVICE
GPS DEMODULATOR
OPERATION BOARD
PIEZOELECTRIC VIBRATING GYRO
ALTITUDE SENSOR
22
28
20
GPS INFORMATION PROCESSING ECU
RETRIEVAL ENGINE
27
MAP DATABASE
VEHICLE SPEED PULSES
4B5
4B2
4B3
4B4
4f4
4
4B1
1
DISPLAY DEVICE
OPERATION/ DISPLAY BOARD
3
2
19
4f1
4f2
4f3
CHARGE CONTROL ECU
EXTERNAL INTERFACE
INTERRUPTION
INTERRUPTION
INTERRUPTION
CARD READER
5
9
PHOTOCOUPLER
VOICE SYNTHESIZING UNIT
20
CARD
CRD
7
VOICE
10
MODEM
VOICE BAND SIGNAL
VOICE RECOGNITION UNIT
6
VOICE
11
EXTENTION SERIAL
TELEPHONE UNIT
SWITCH SW
SERIAL
VOICE
8
ANTt
+B
MIC
VEHICLE SPEED PULSES
PSC
IN-VEHICLE AUDIO
SP
POWER SUPPLY CIRCUIT
BAT
I
G_SW
IN-VEHICLE SPEAKER
Si
INPUT I/F

F I G. 3 7



TOKKAI 2000-236560

FIG. 38



F I G. 3 9 A

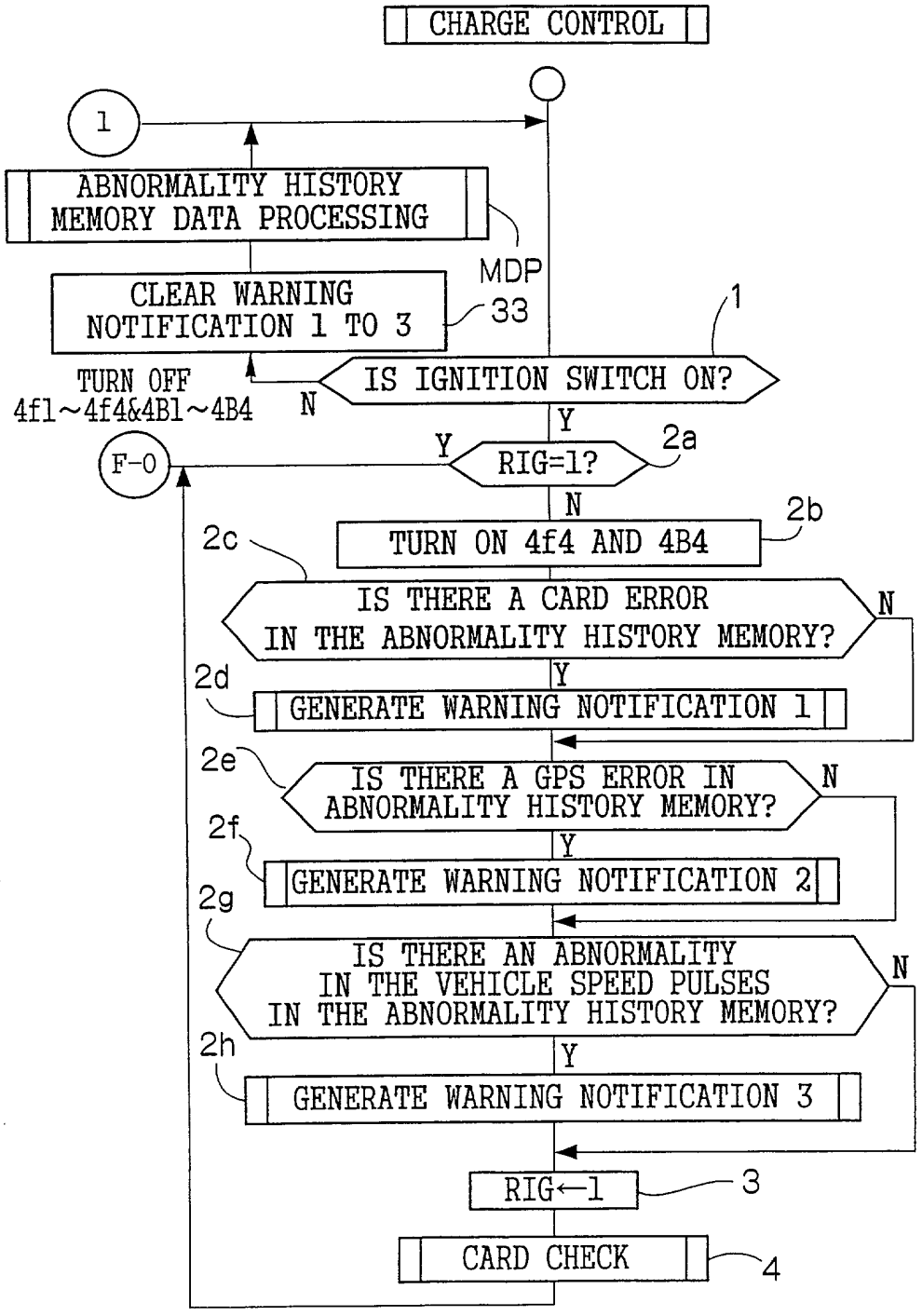


FIG.39A 2006-268950

FIG. 39 B

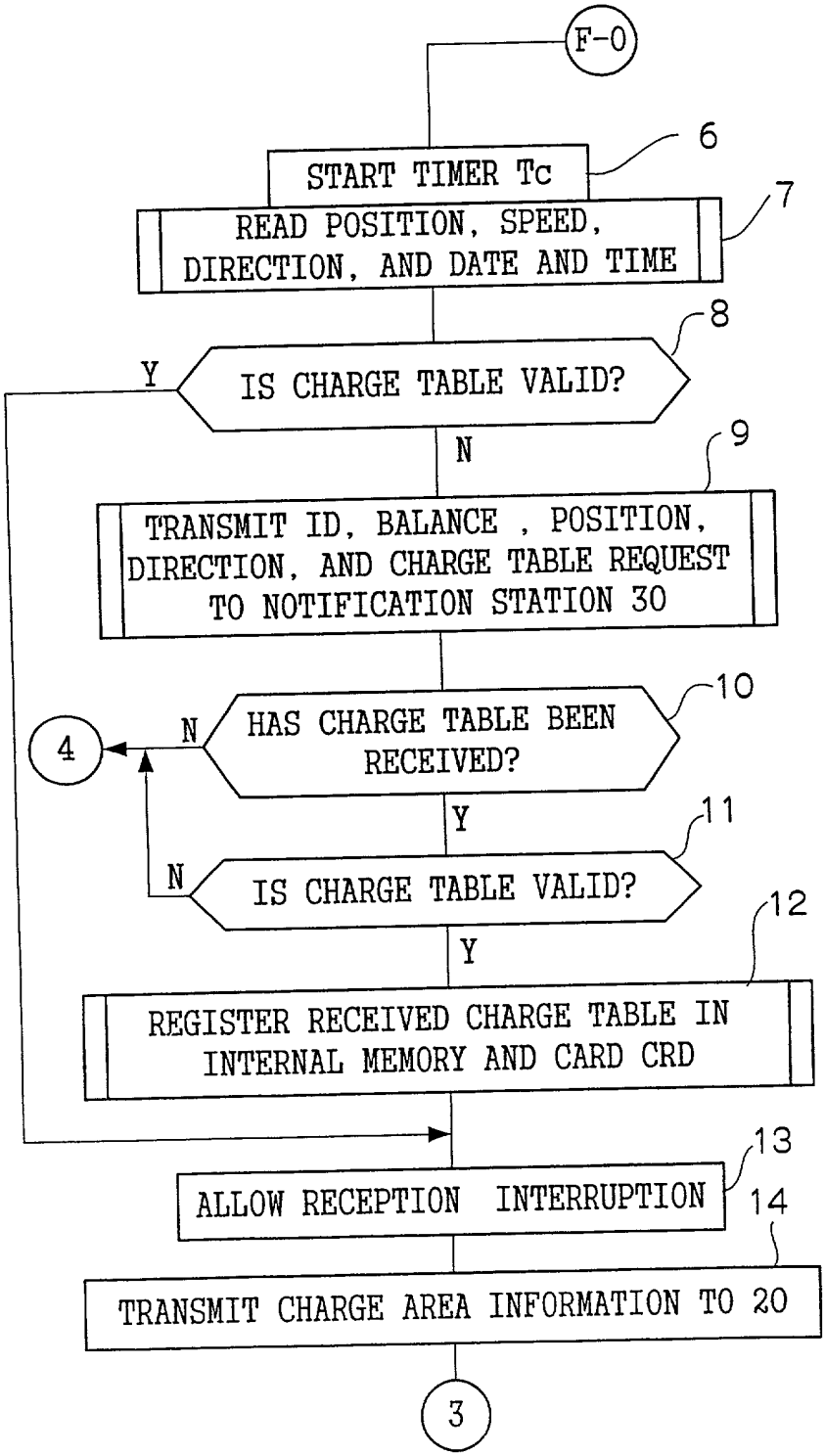

F-0
START TIMER Tc
6
READ POSITION, SPEED, DIRECTION, AND DATE AND TIME
7
IS CHARGE TABLE VALID?
8
Y
N
TRANSMIT ID, BALANCE , POSITION, DIRECTION, AND CHARGE TABLE REQUEST TO NOTIFICATION STATION 30
9
HAS CHARGE TABLE BEEN RECEIVED?
10
N
4
Y
IS CHARGE TABLE VALID?
11
N
Y
REGISTER RECEIVED CHARGE TABLE IN INTERNAL MEMORY AND CARD CRD
12
ALLOW RECEPTION INTERRUPTION
13
TRANSMIT CHARGE AREA INFORMATION TO 20
14
3

FIG. 40A

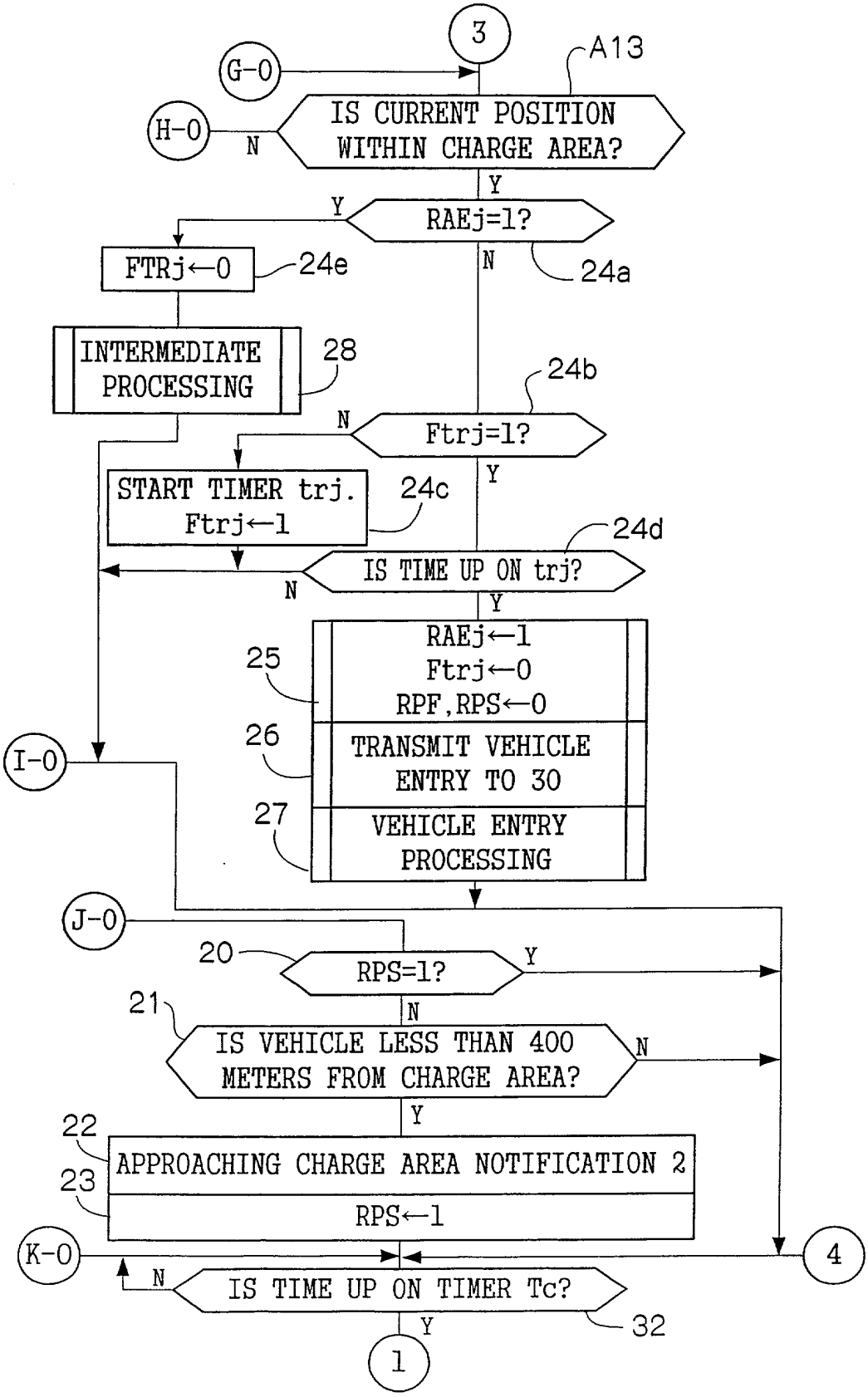

3
G-0
A13
H-0
IS CURRENT POSITION WITHIN CHARGE AREA?
N
Y
RAEj=1?
Y
N
FTRj←0
24e
24a
INTERMEDIATE PROCESSING
28
24b
Ftrj=1?
N
Y
START TIMER trj.
Ftrj←1
24c
24d
IS TIME UP ON trj?
N
Y
RAEj←1
Ftrj←0
RPF,RPS←0
25
TRANSMIT VEHICLE ENTRY TO 30
26
VEHICLE ENTRY PROCESSING
27
I-0
J-0
20
RPS=1?
Y
N
21
IS VEHICLE LESS THAN 400 METERS FROM CHARGE AREA?
N
Y
22
APPROACHING CHARGE AREA NOTIFICATION 2
23
RPS←1
K-0
4
N
IS TIME UP ON TIMER Tc?
32
Y
1

FIG. 40B

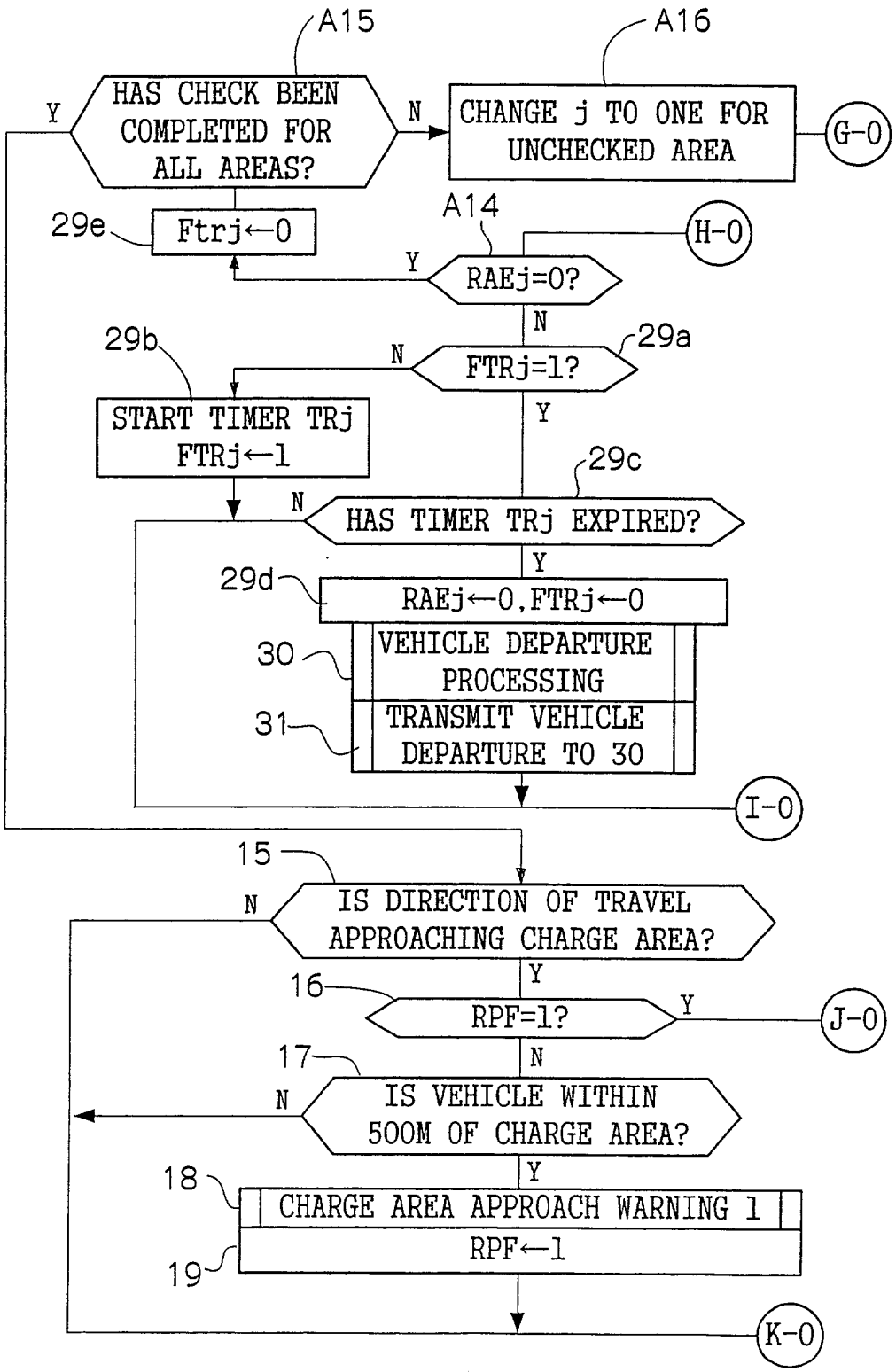


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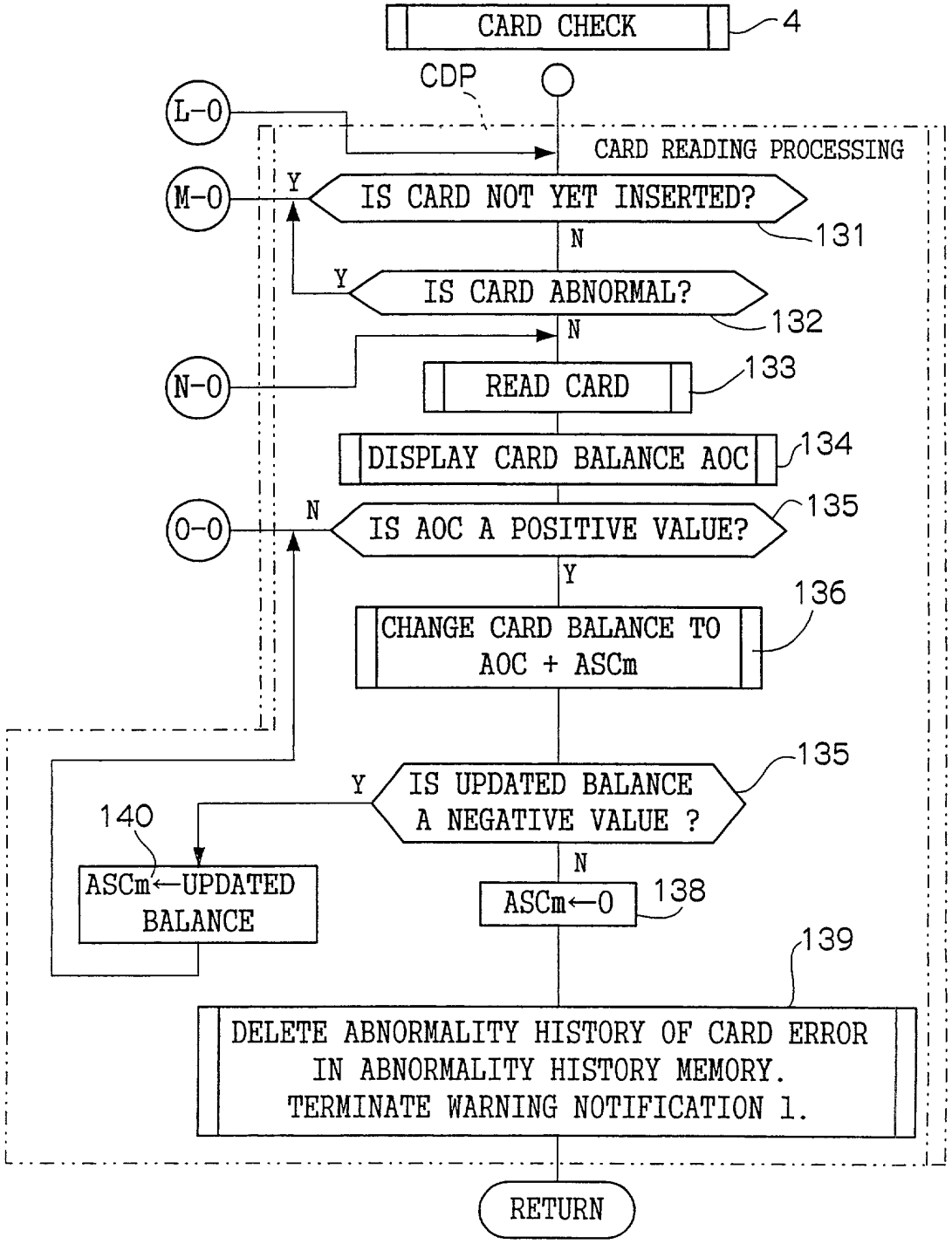
FIG. 41A



EP 0 952 552 A2 19991027

FIG. 41B

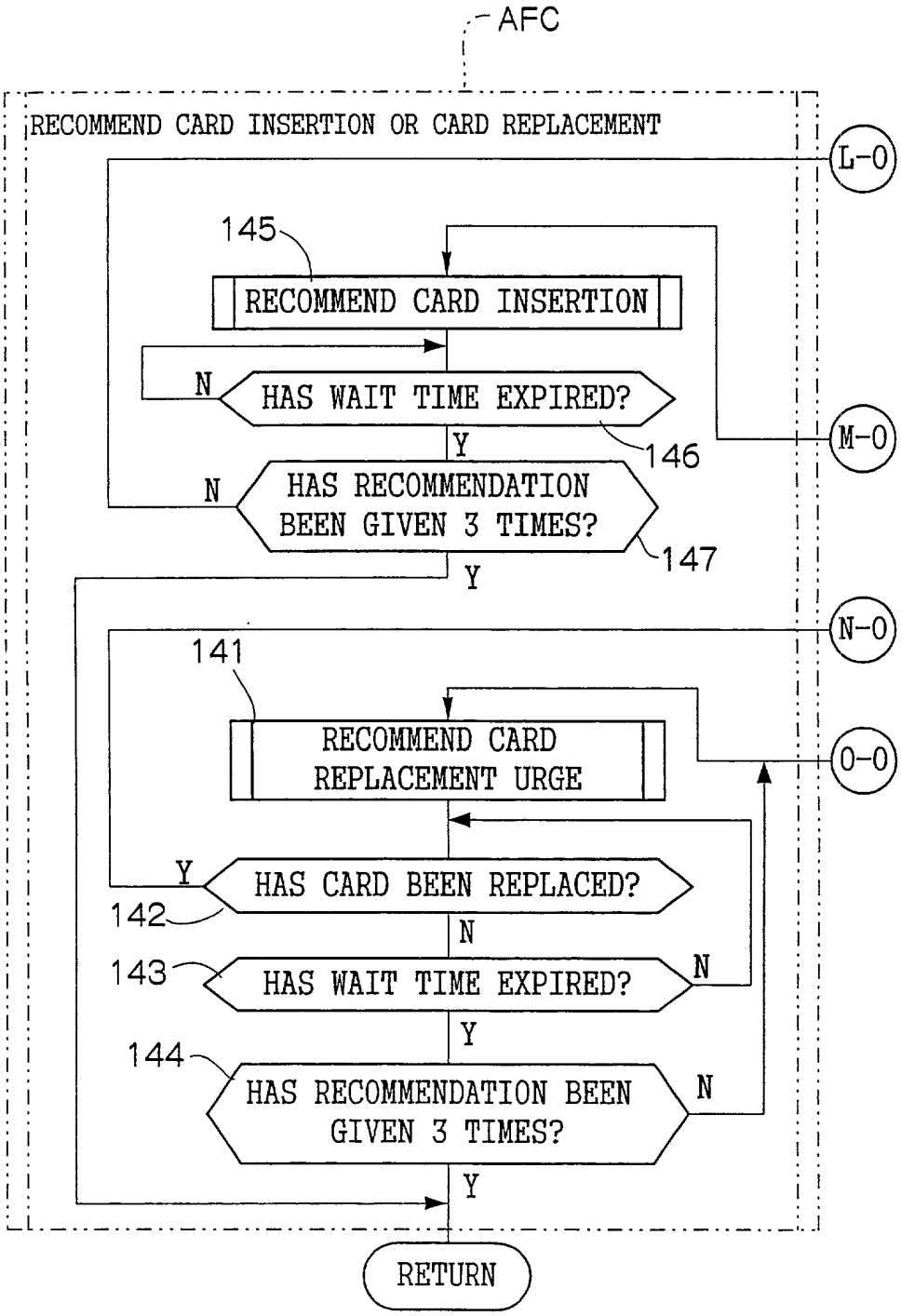
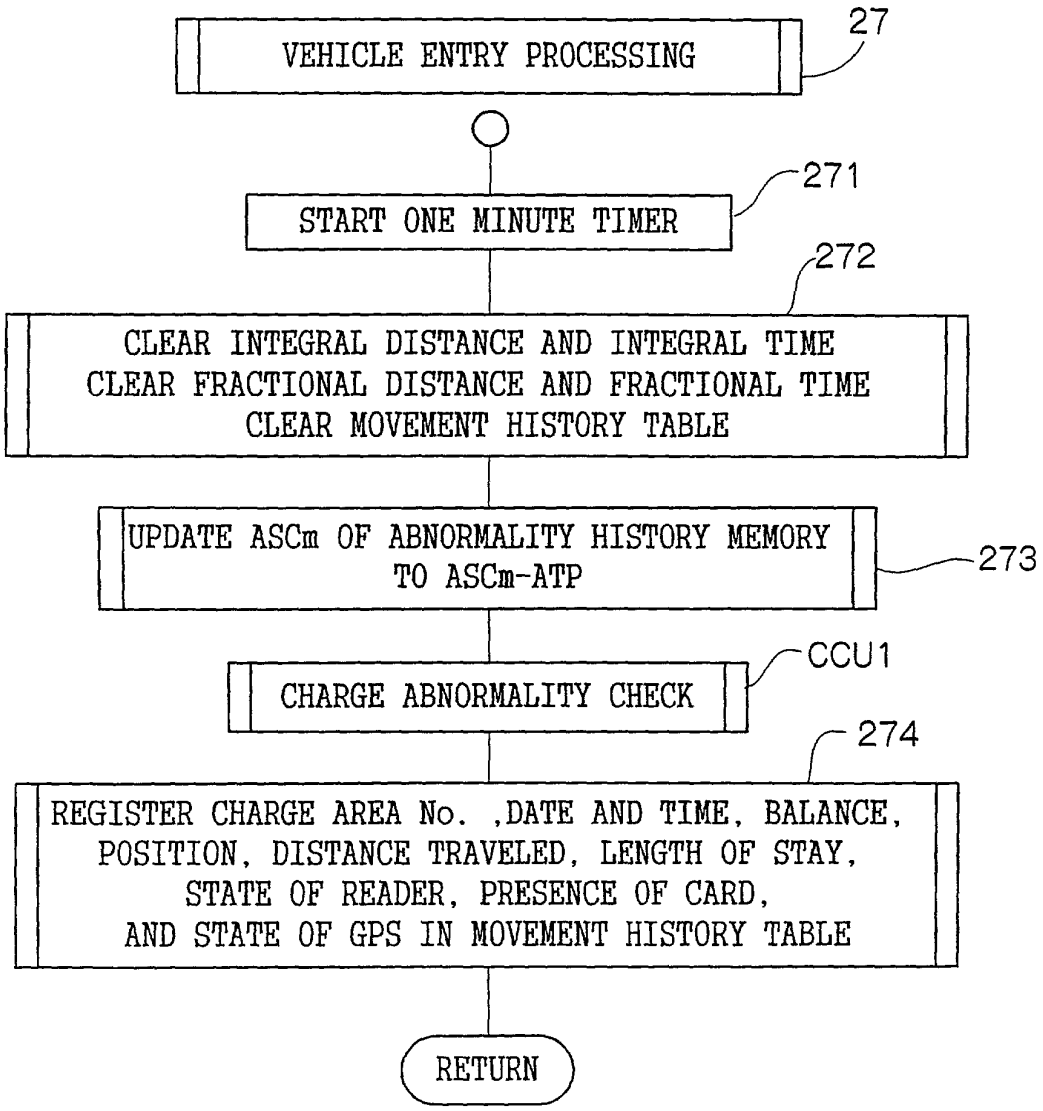

AFC
RECOMMEND CARD INSERTION OR CARD REPLACEMENT
L-0
145
RECOMMEND CARD INSERTION
N
HAS WAIT TIME EXPIRED?
Y
146
M-0
N
HAS RECOMMENDATION BEEN GIVEN 3 TIMES?
147
Y
N-0
141
RECOMMEND CARD REPLACEMENT URGE
O-0
Y
HAS CARD BEEN REPLACED?
142
N
143
HAS WAIT TIME EXPIRED?
N
Y
144
HAS RECOMMENDATION BEEN GIVEN 3 TIMES?
N
Y
RETURN

FIG. 42



JP2003-76694

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FIG. 43

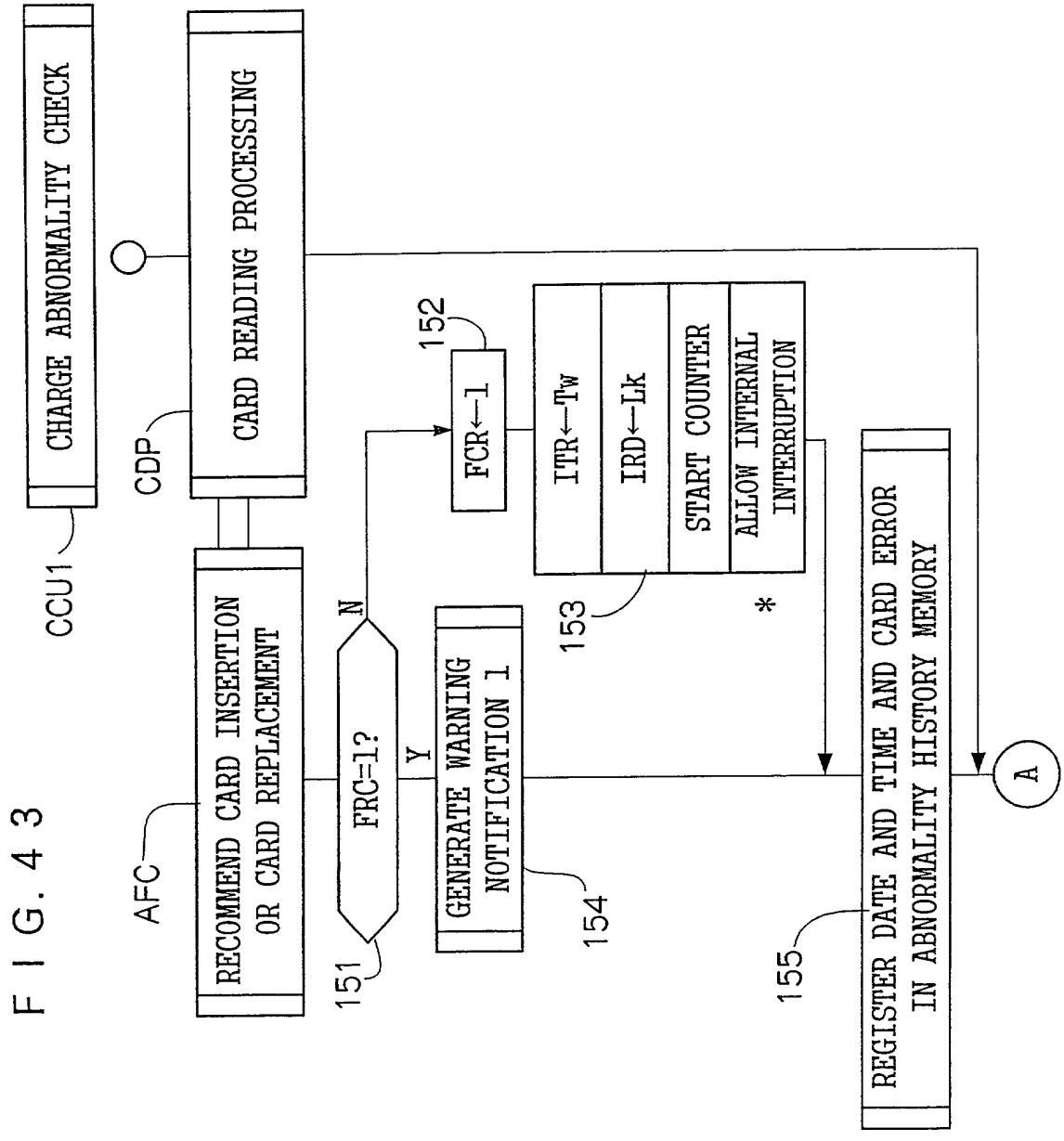
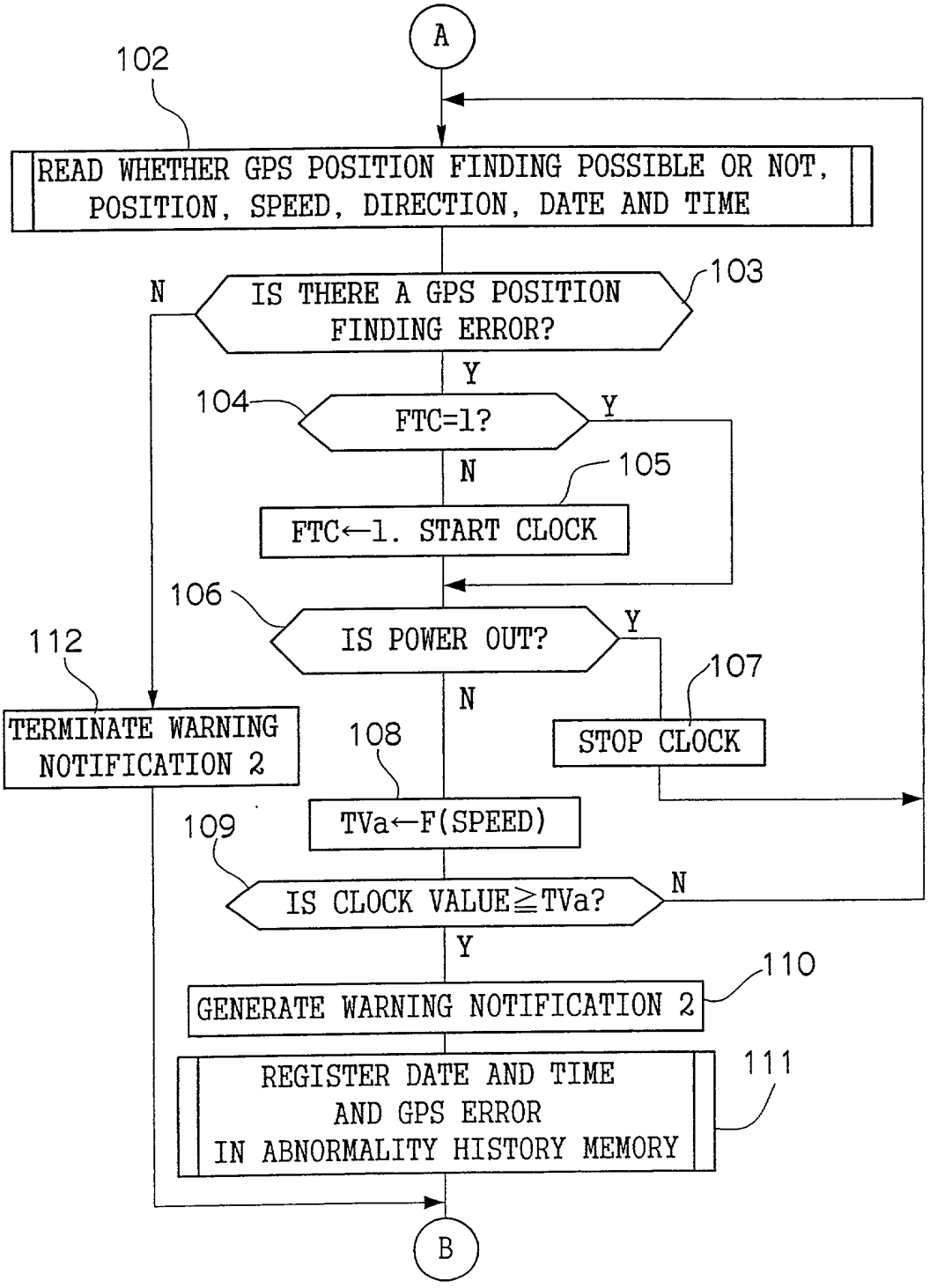
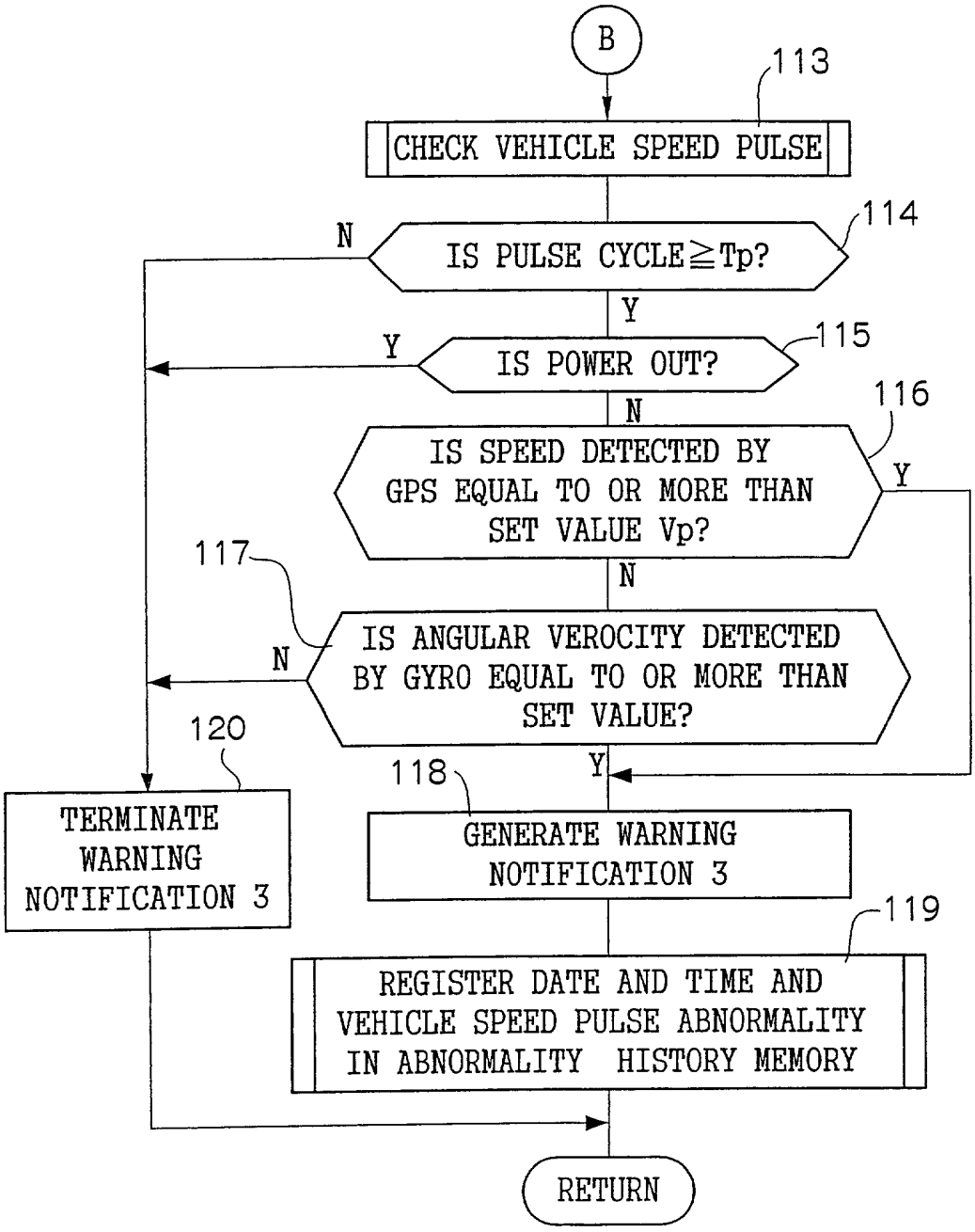


FIG. 44



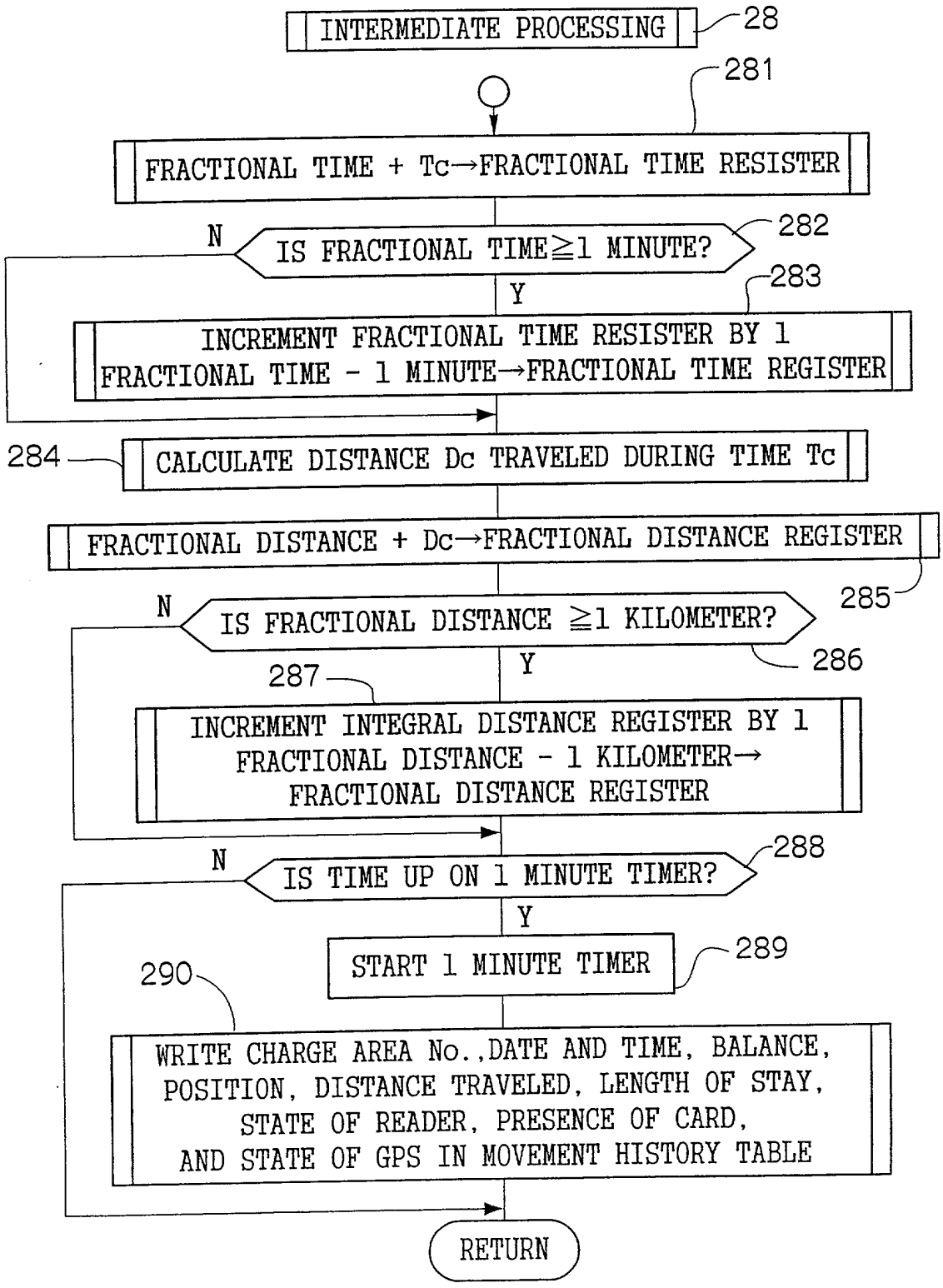
JP2004-295690

FIG. 45



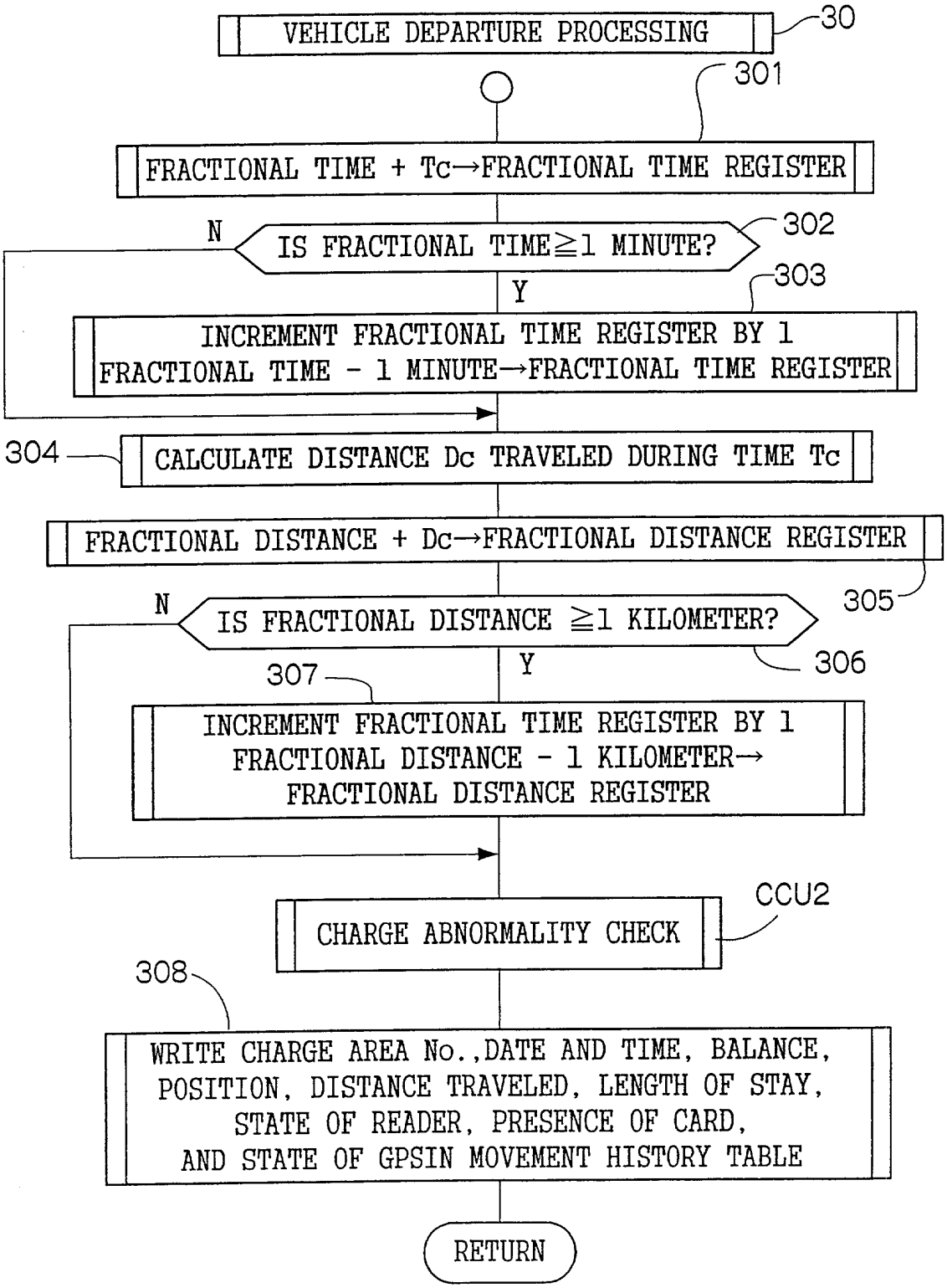
JP2005-265759 A 2005.09.29

FIG. 46



1-0569-0226-0 Copyright

F I G. 4 7



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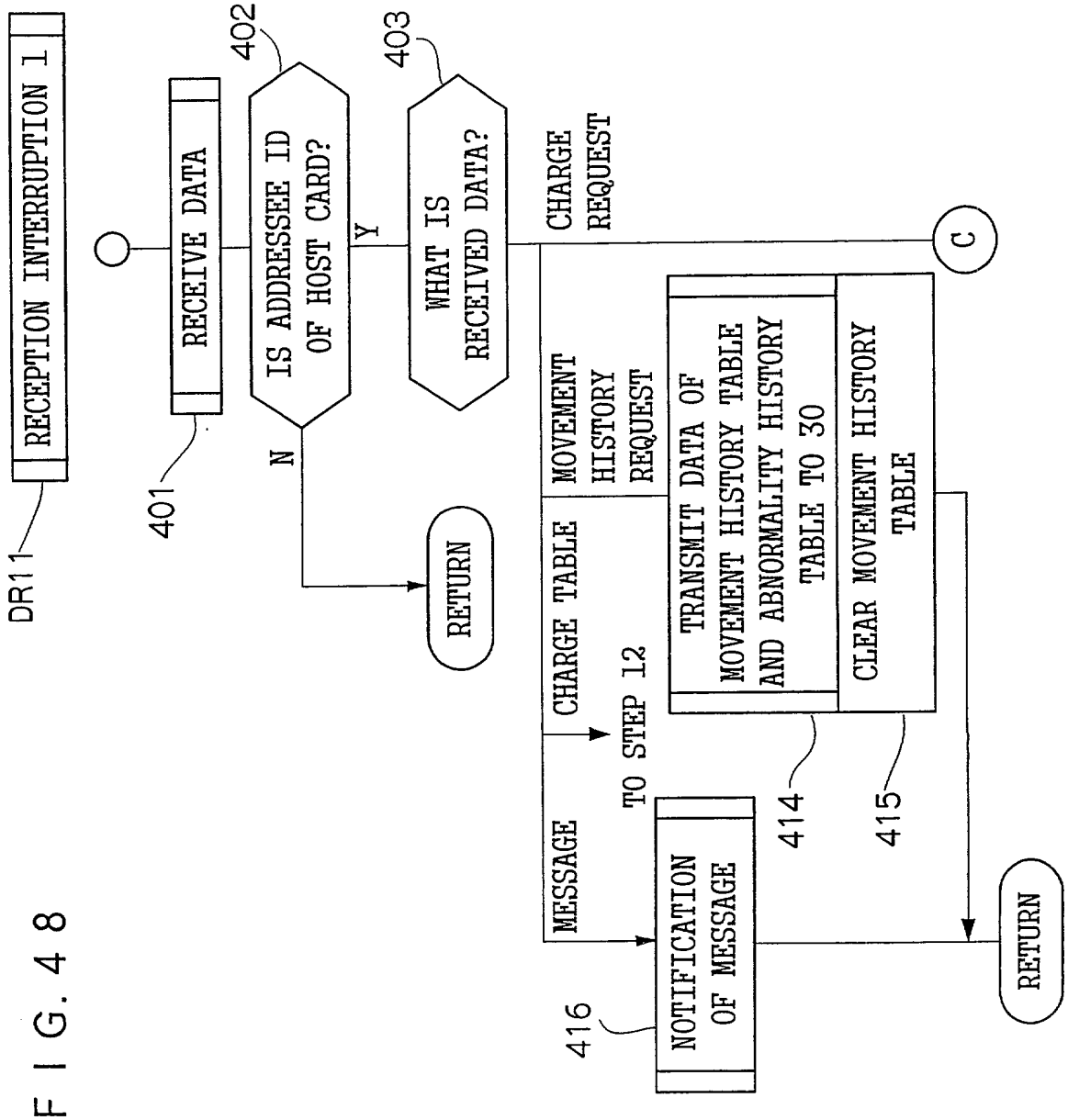
TOCHIBA

FIG. 48



EP 0 622 760 A2

FIG. 49

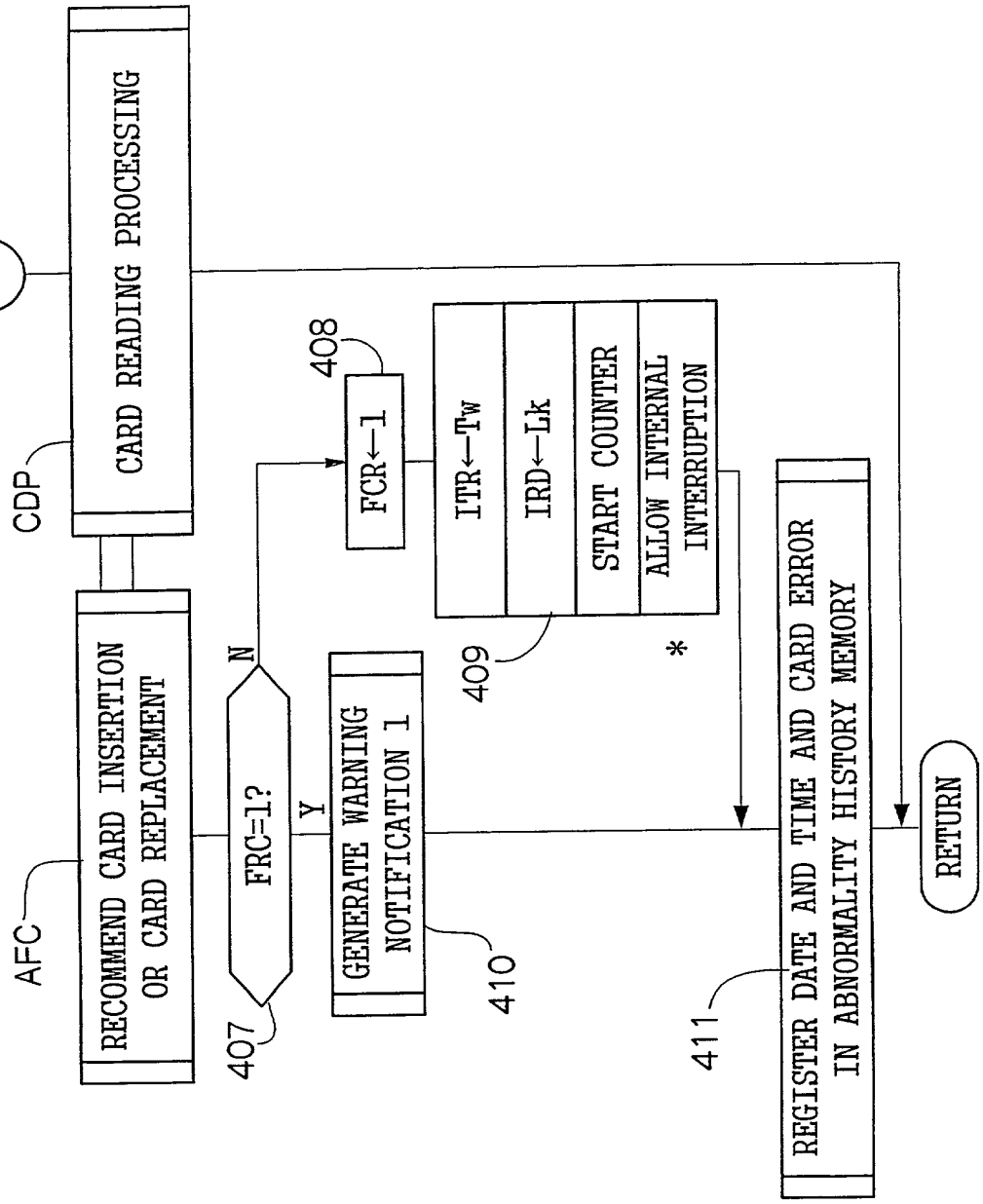


FIG. 50

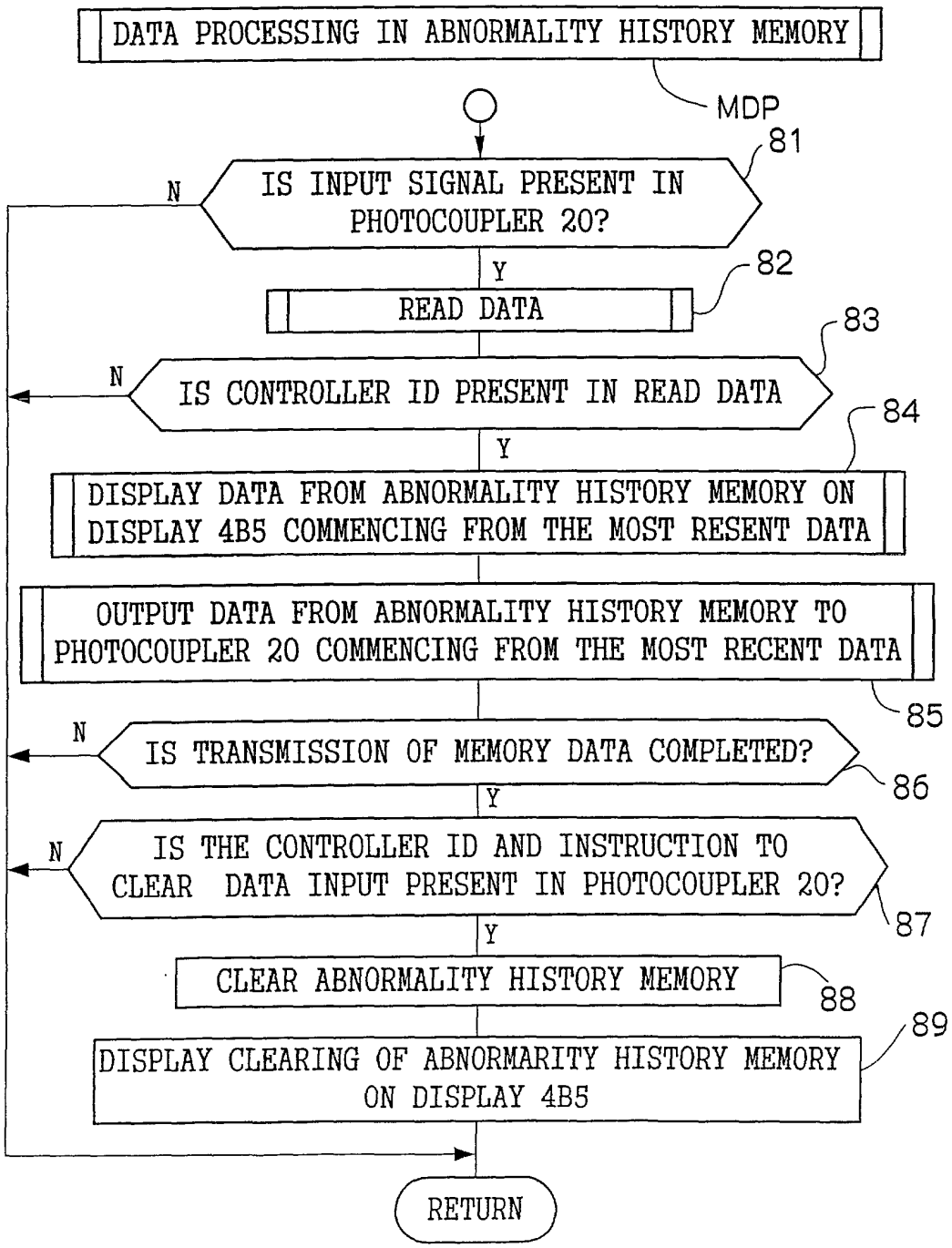

DATA PROCESSING IN ABNORMALITY HISTORY MEMORY
MDP
81
IS INPUT SIGNAL PRESENT IN PHOTOCOUPLER 20?
N
Y
82
READ DATA
83
IS CONTROLLER ID PRESENT IN READ DATA
N
Y
84
DISPLAY DATA FROM ABNORMALITY HISTORY MEMORY ON DISPLAY 4B5 COMMENCING FROM THE MOST RESENT DATA
OUTPUT DATA FROM ABNORMALITY HISTORY MEMORY TO PHOTOCOUPLER 20 COMMENCING FROM THE MOST RECENT DATA
85
IS TRANSMISSION OF MEMORY DATA COMPLETED?
N
86
Y
IS THE CONTROLLER ID AND INSTRUCTION TO CLEAR DATA INPUT PRESENT IN PHOTOCOUPLER 20?
N
87
Y
CLEAR ABNORMALITY HISTORY MEMORY
88
DISPLAY CLEARING OF ABNORMARITY HISTORY MEMORY ON DISPLAY 4B5
89
RETURN

FIG. 51A

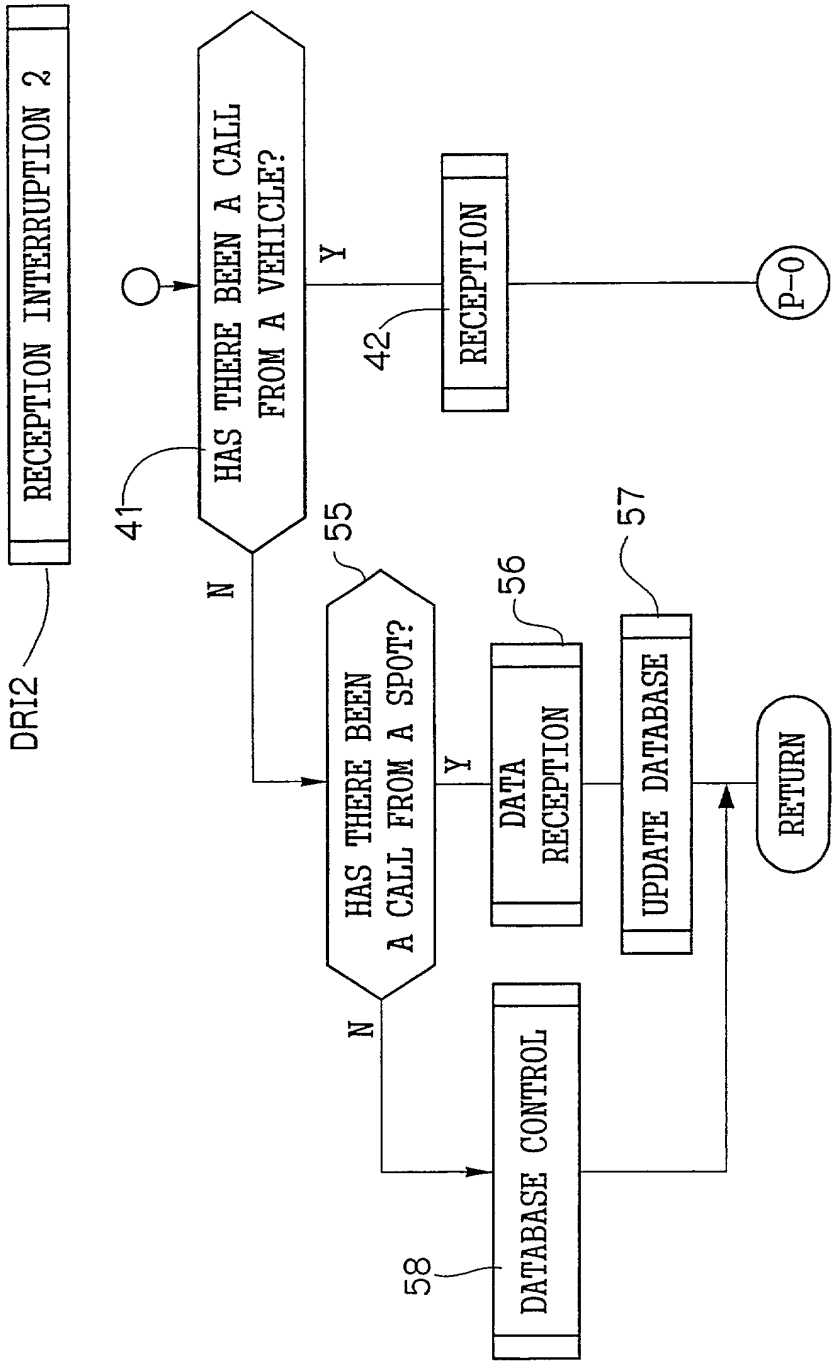

RECEPTION INTERRUPTION 2
DRI2
41
HAS THERE BEEN A CALL FROM A VEHICLE?
N
Y
42
RECEPTION
P-0
55
HAS THERE BEEN A CALL FROM A SPOT?
N
Y
56
DATA RECEPTION
57
UPDATE DATABASE
RETURN
58
DATABASE CONTROL

FIG. 51B

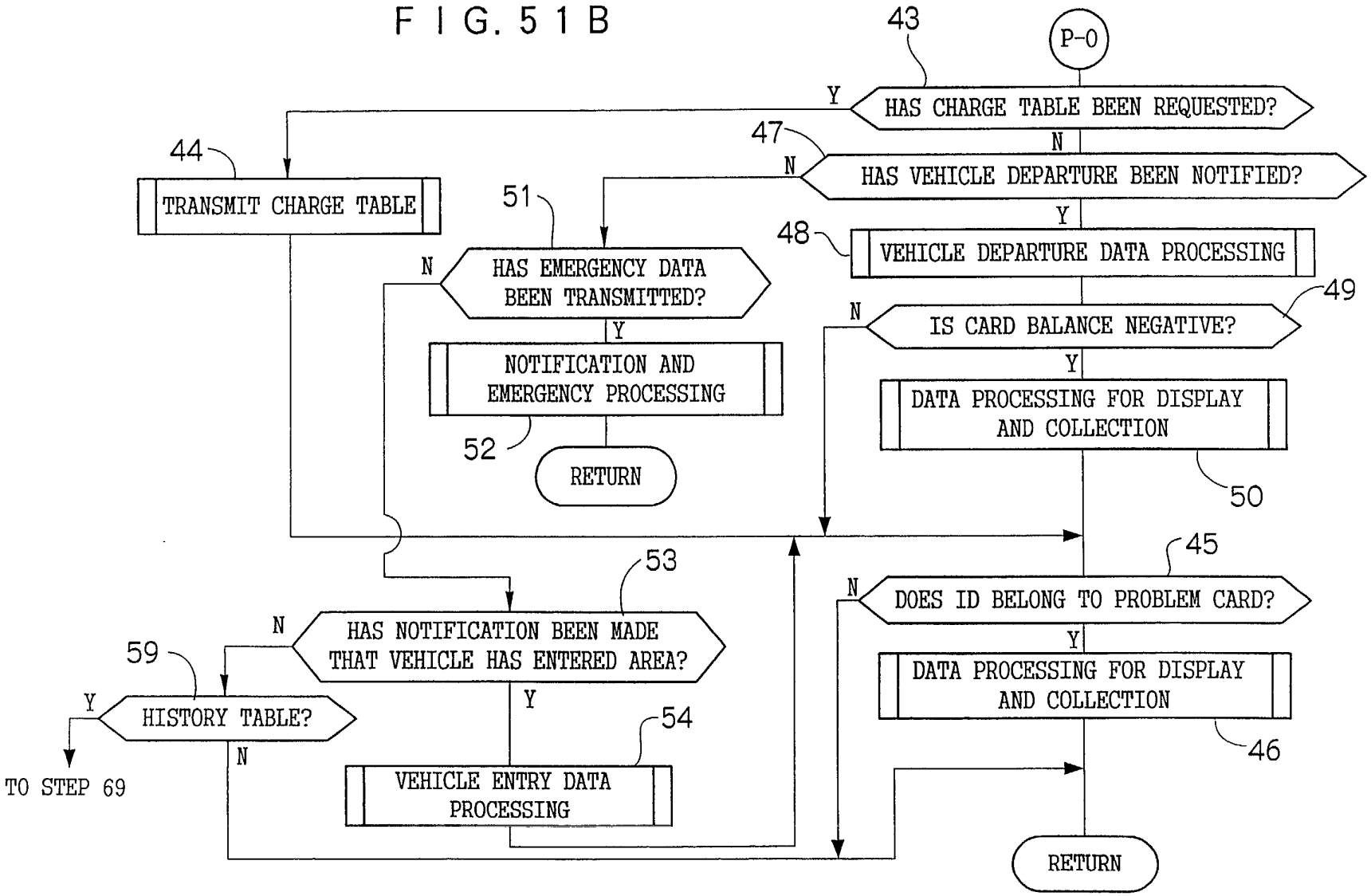
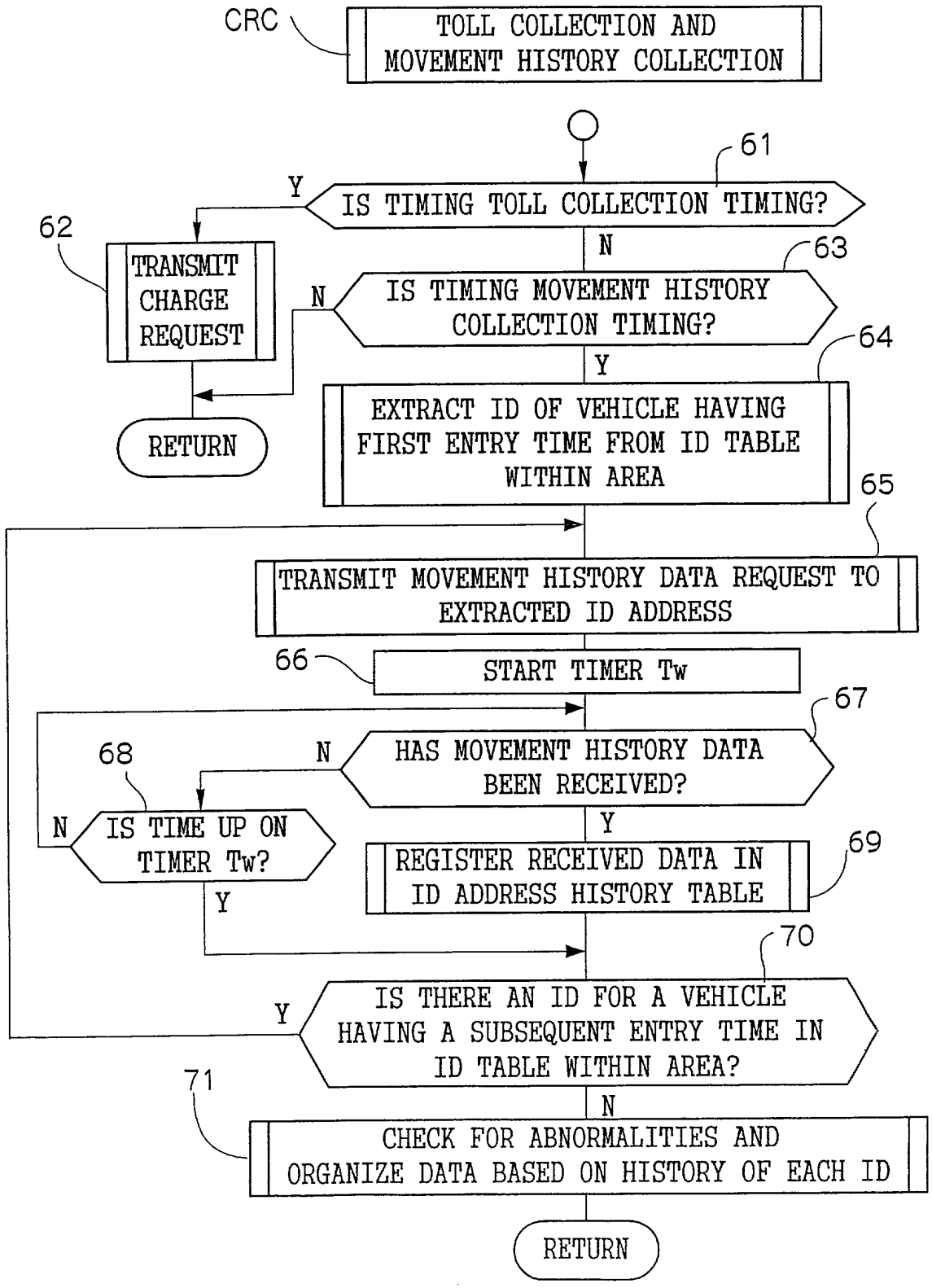

43
P-0
HAS CHARGE TABLE BEEN REQUESTED?
Y
N
47
HAS VEHICLE DEPARTURE BEEN NOTIFIED?
N
Y
44
TRANSMIT CHARGE TABLE
51
48
VEHICLE DEPARTURE DATA PROCESSING
N
HAS EMERGENCY DATA BEEN TRANSMITTED?
49
N
IS CARD BALANCE NEGATIVE?
Y
NOTIFICATION AND EMERGENCY PROCESSING
Y
DATA PROCESSING FOR DISPLAY AND COLLECTION
52
RETURN
50
45
53
N
DOES ID BELONG TO PROBLEM CARD?
N
HAS NOTIFICATION BEEN MADE THAT VEHICLE HAS ENTERED AREA?
59
Y
DATA PROCESSING FOR DISPLAY AND COLLECTION
Y
HISTORY TABLE?
54
Y
N
46
TO STEP 69
VEHICLE ENTRY DATA PROCESSING
RETURN

FIG. 52



EP0962901A2

FIG. 53A

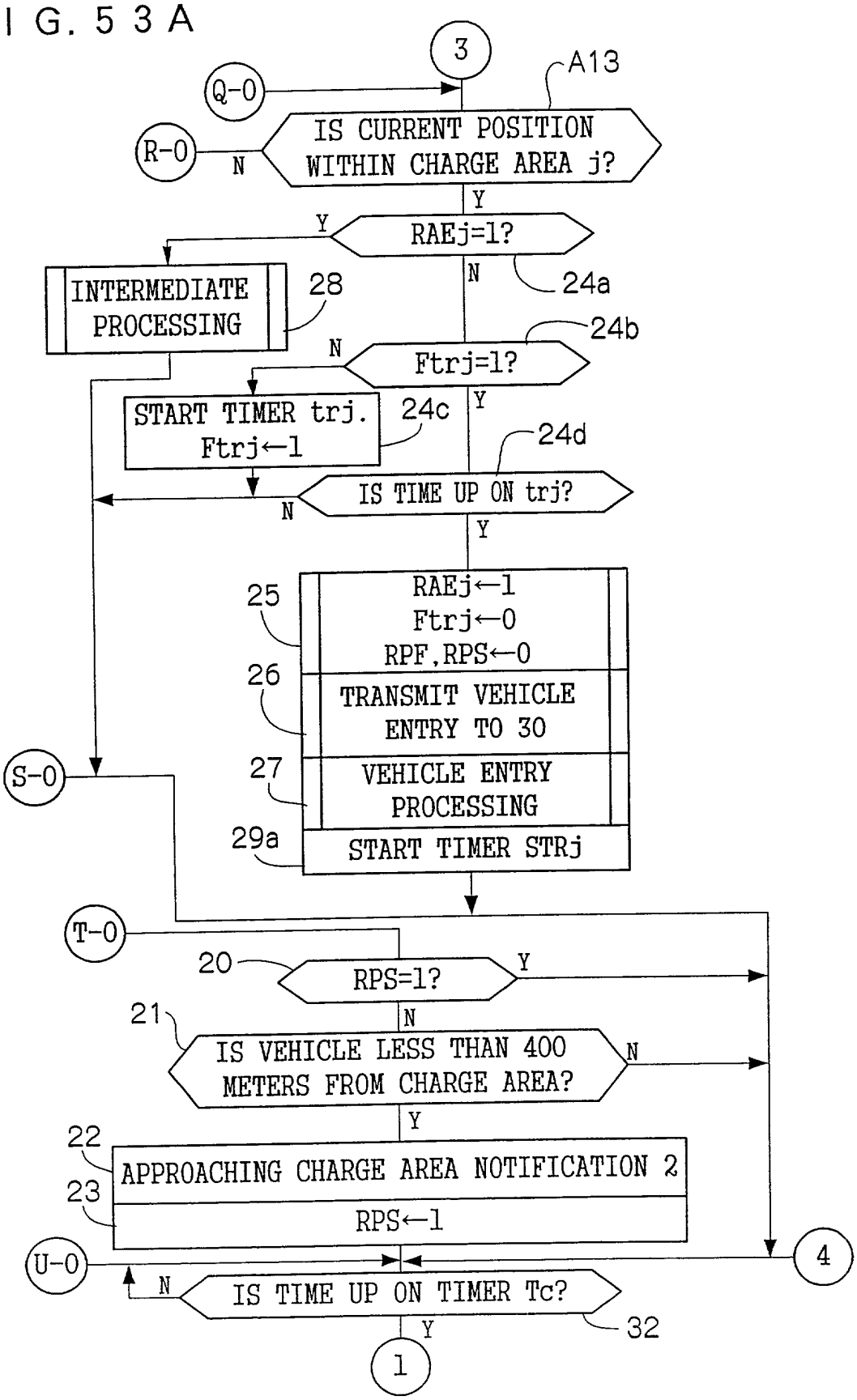
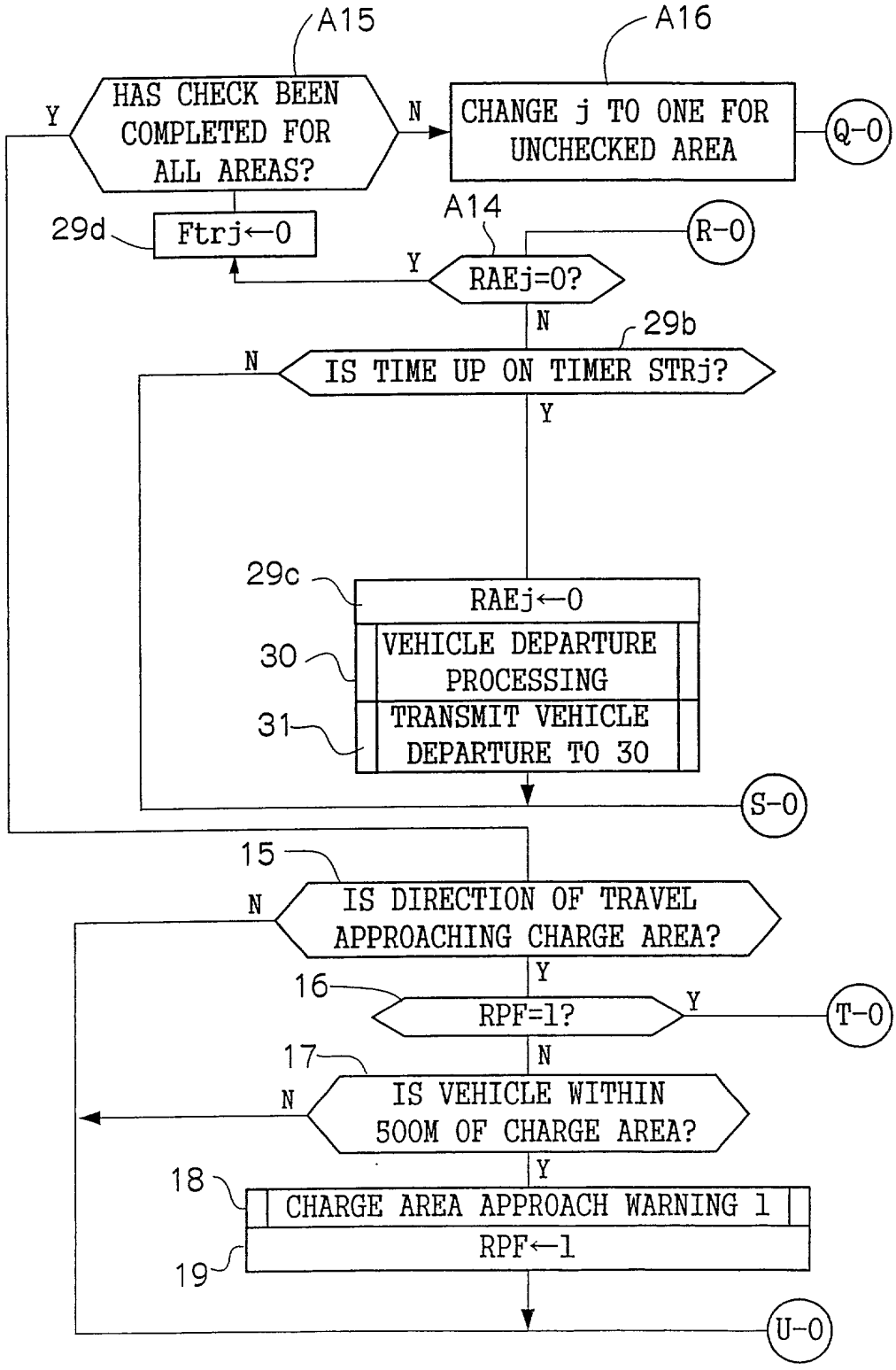

3
A13
Q-0
IS CURRENT POSITION WITHIN CHARGE AREA j?
R-0
N
Y
RAEj=1?
Y
N
24a
INTERMEDIATE PROCESSING
28
24b
N
Ftrj=1?
START TIMER trj.
Ftrj←1
24c
Y
24d
IS TIME UP ON trj?
N
Y
25
RAEj←1
Ftrj←0
RPF,RPS←0
26
TRANSMIT VEHICLE ENTRY TO 30
27
VEHICLE ENTRY PROCESSING
29a
START TIMER STRj
S-0
T-0
20
RPS=1?
Y
N
21
IS VEHICLE LESS THAN 400 METERS FROM CHARGE AREA?
N
Y
22
APPROACHING CHARGE AREA NOTIFICATION 2
23
RPS←1
U-0
4
N
IS TIME UP ON TIMER Tc?
32
Y
1

FIG. 53B



FP05-0280-72-86-10-EP

FIG. 54A

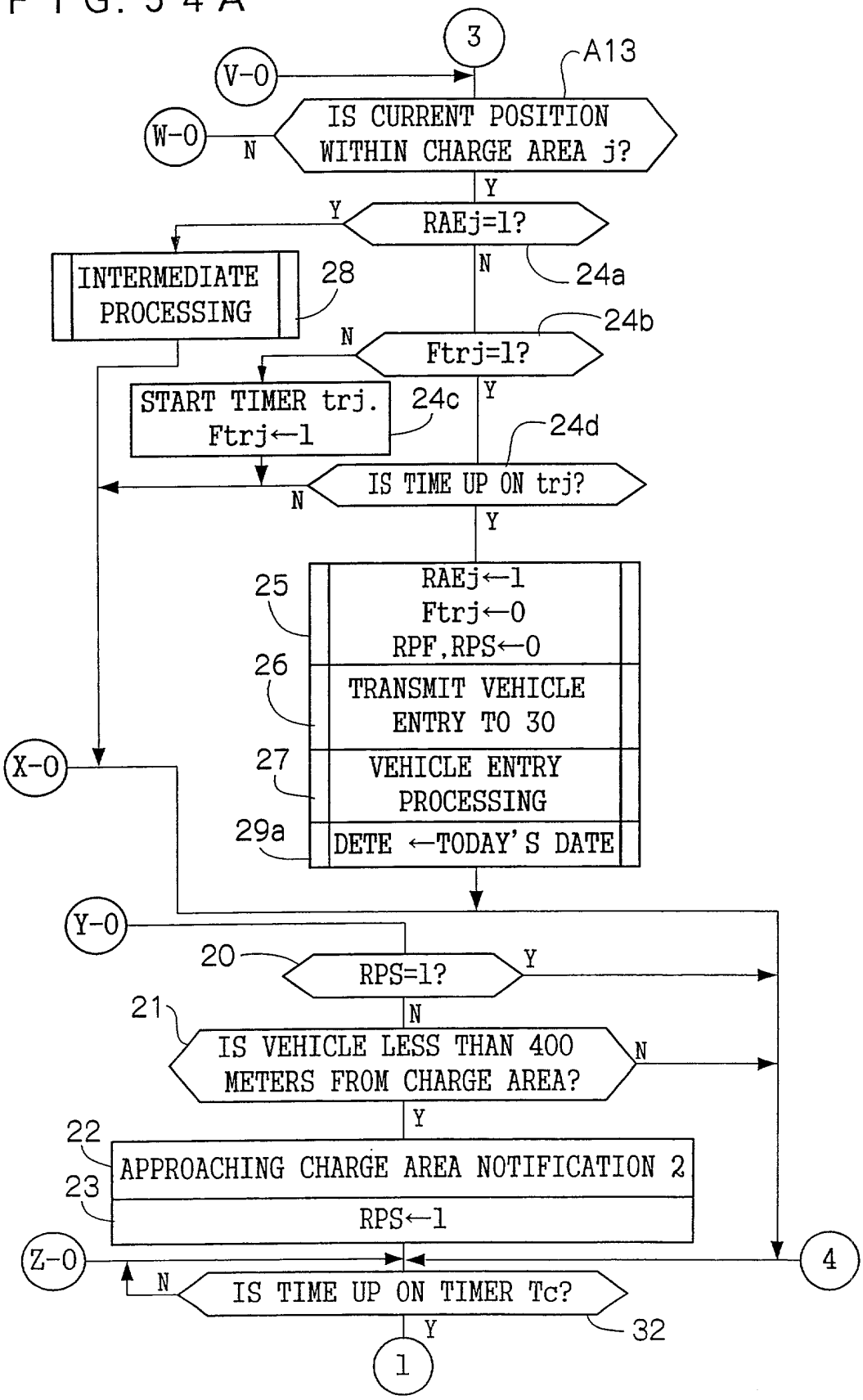


FIG. 54A JP2000-268290

FIG. 54B

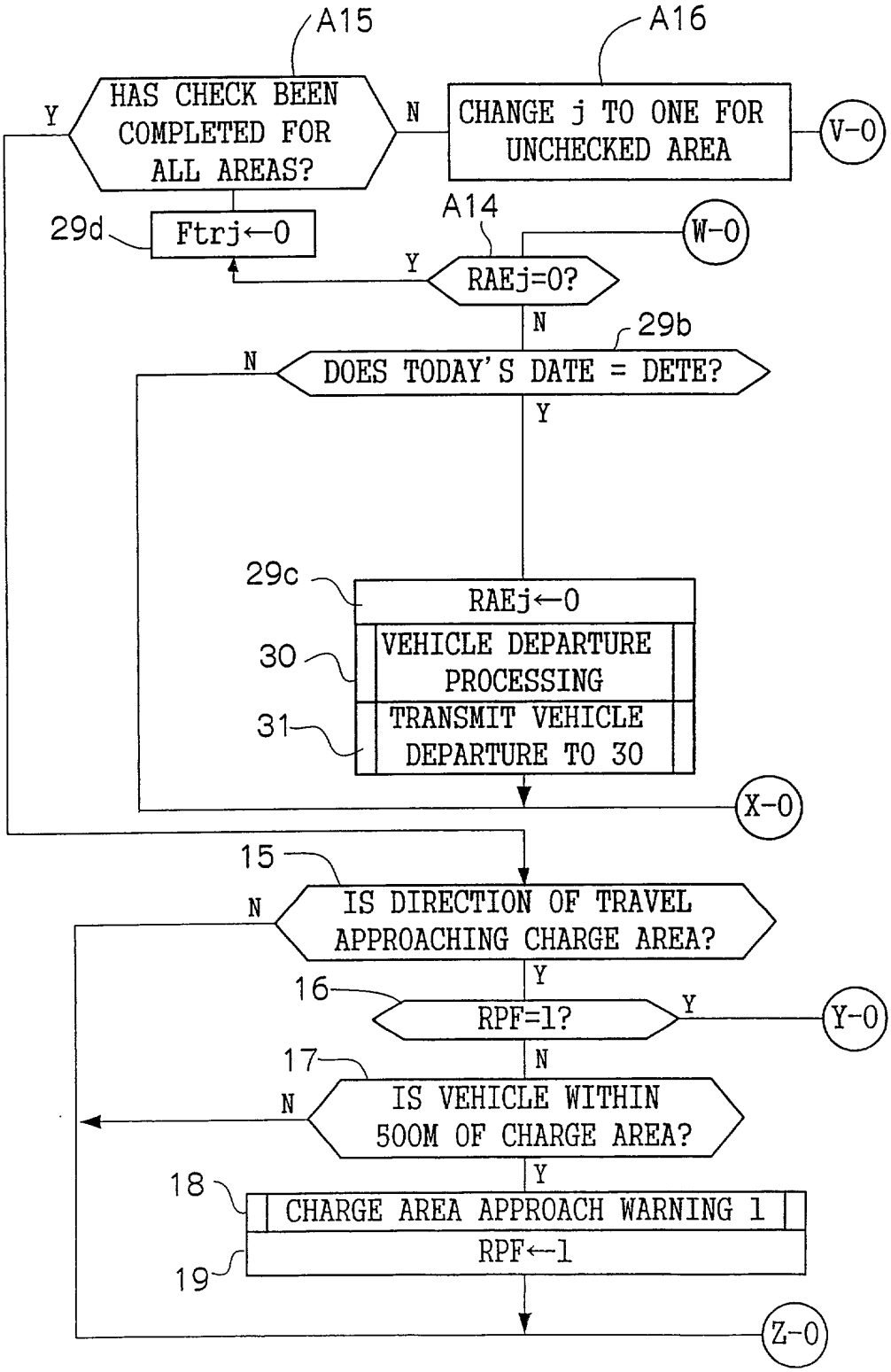

A15
A16
HAS CHECK BEEN COMPLETED FOR ALL AREAS?
Y
N
CHANGE j TO ONE FOR UNCHECKED AREA
V-0
29d
Ftrj←0
A14
W-0
Y
RAEj=0?
N
29b
N
DOES TODAY'S DATE = DETE?
Y
29c
RAEj←0
30
VEHICLE DEPARTURE PROCESSING
31
TRANSMIT VEHICLE DEPARTURE TO 30
X-0
15
N
IS DIRECTION OF TRAVEL APPROACHING CHARGE AREA?
Y
16
RPF=1?
Y
Y-0
17
N
N
IS VEHICLE WITHIN 500M OF CHARGE AREA?
Y
18
CHARGE AREA APPROACH WARNING 1
19
RPF←1
Z-0

FIG. 55A

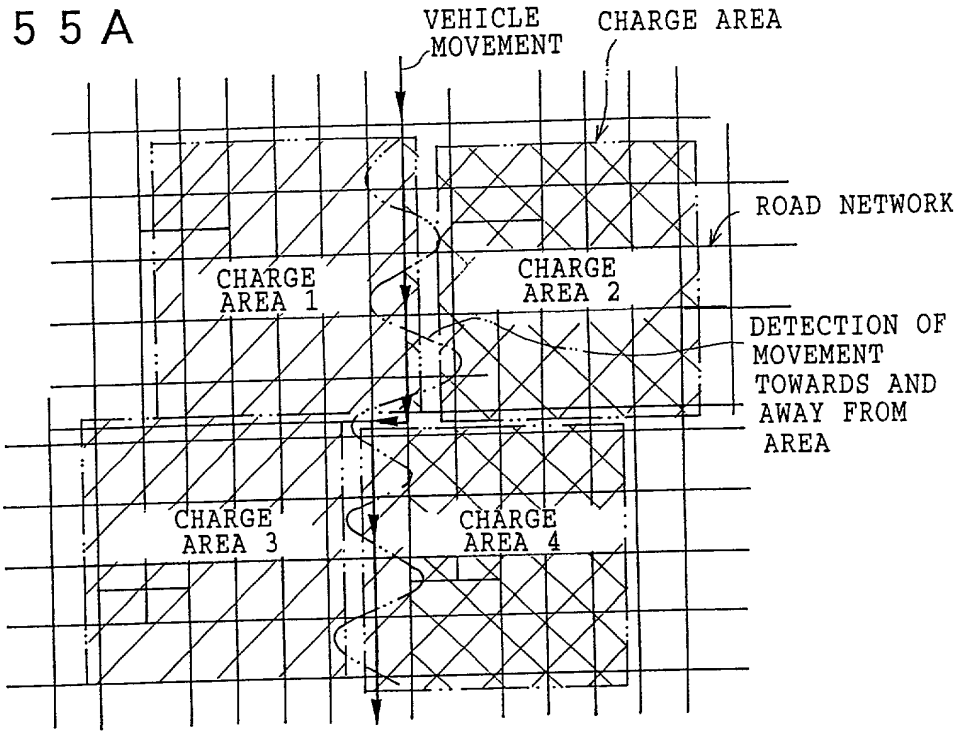
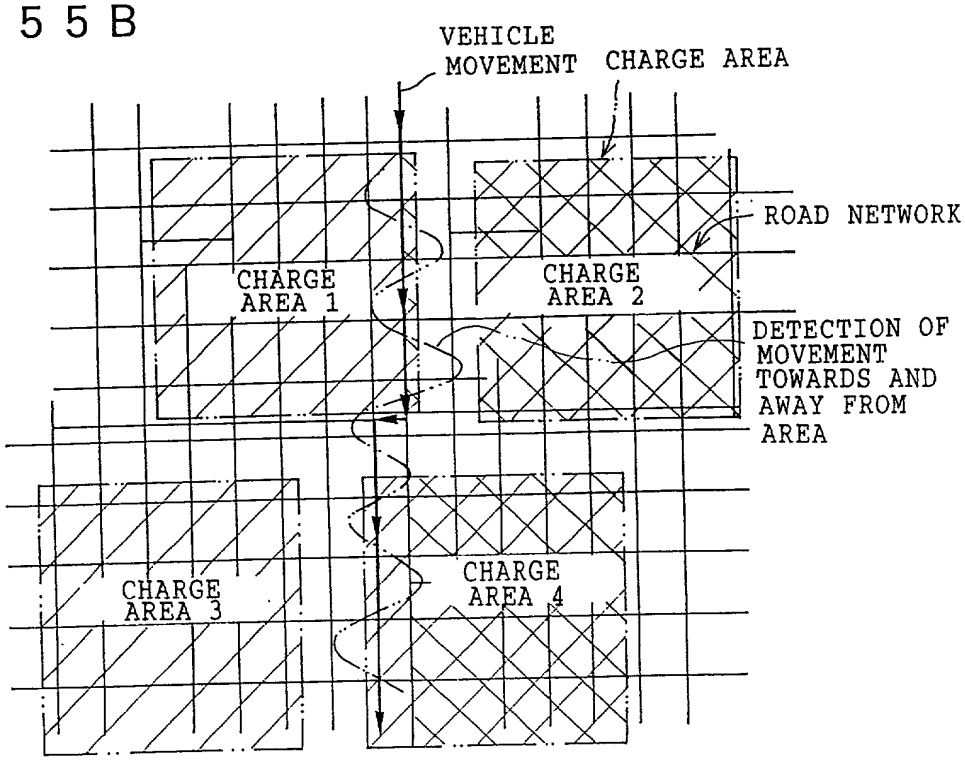
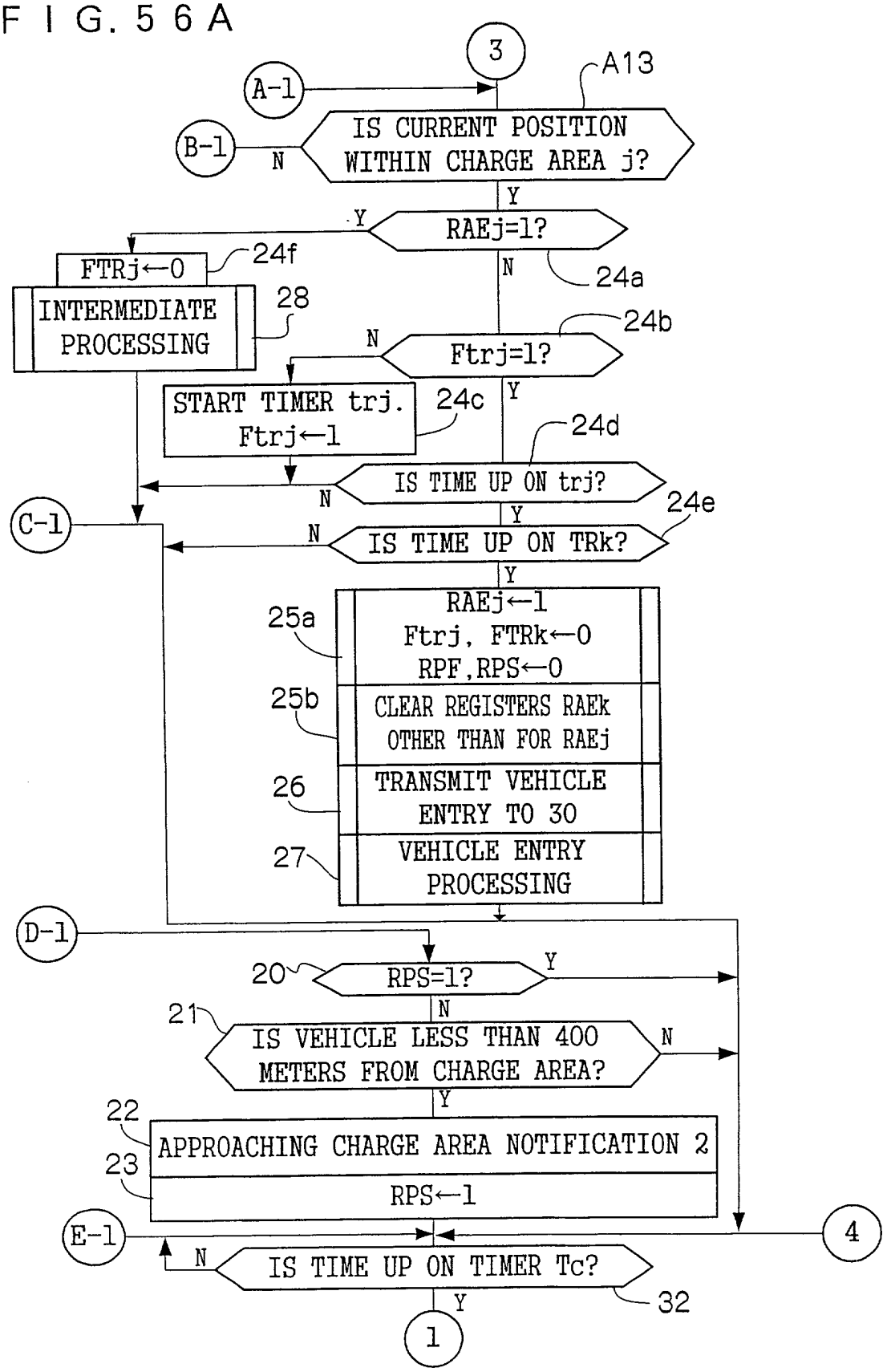


FIG. 55B

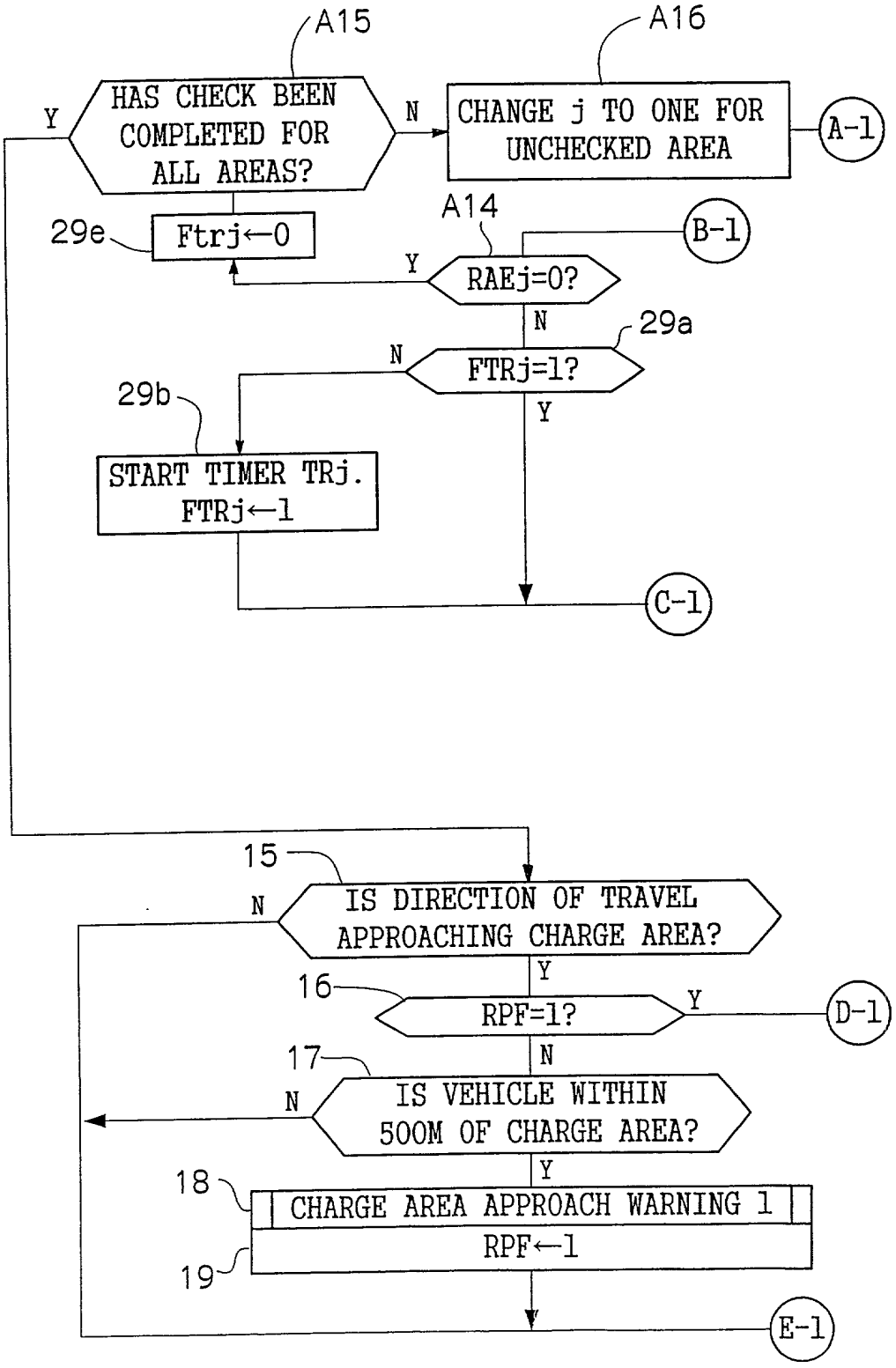


FOREIGN PATENT 2005/0156

F I G. 5 6 A


3
A13
A-1
B-1
IS CURRENT POSITION WITHIN CHARGE AREA j?
N
Y
RAEj=1?
Y
N
24a
FTRj←0
24f
INTERMEDIATE PROCESSING
28
Ftrj=1?
24b
N
START TIMER trj.
Ftrj←1
24c
Y
24d
IS TIME UP ON trj?
N
Y
C-1
IS TIME UP ON TRk?
24e
N
Y
RAEj←1
Ftrj, FTRk←0
RPF,RPS←0
25a
CLEAR REGISTERS RAEk OTHER THAN FOR RAEj
25b
TRANSMIT VEHICLE ENTRY TO 30
26
VEHICLE ENTRY PROCESSING
27
D-1
RPS=1?
20
Y
N
IS VEHICLE LESS THAN 400 METERS FROM CHARGE AREA?
21
N
Y
APPROACHING CHARGE AREA NOTIFICATION 2
22
RPS←1
23
E-1
4
IS TIME UP ON TIMER Tc?
N
Y
32
1

F I G. 5 6 B



JP05256660A 2025/10/09

EP0562423A1

FIG.57A

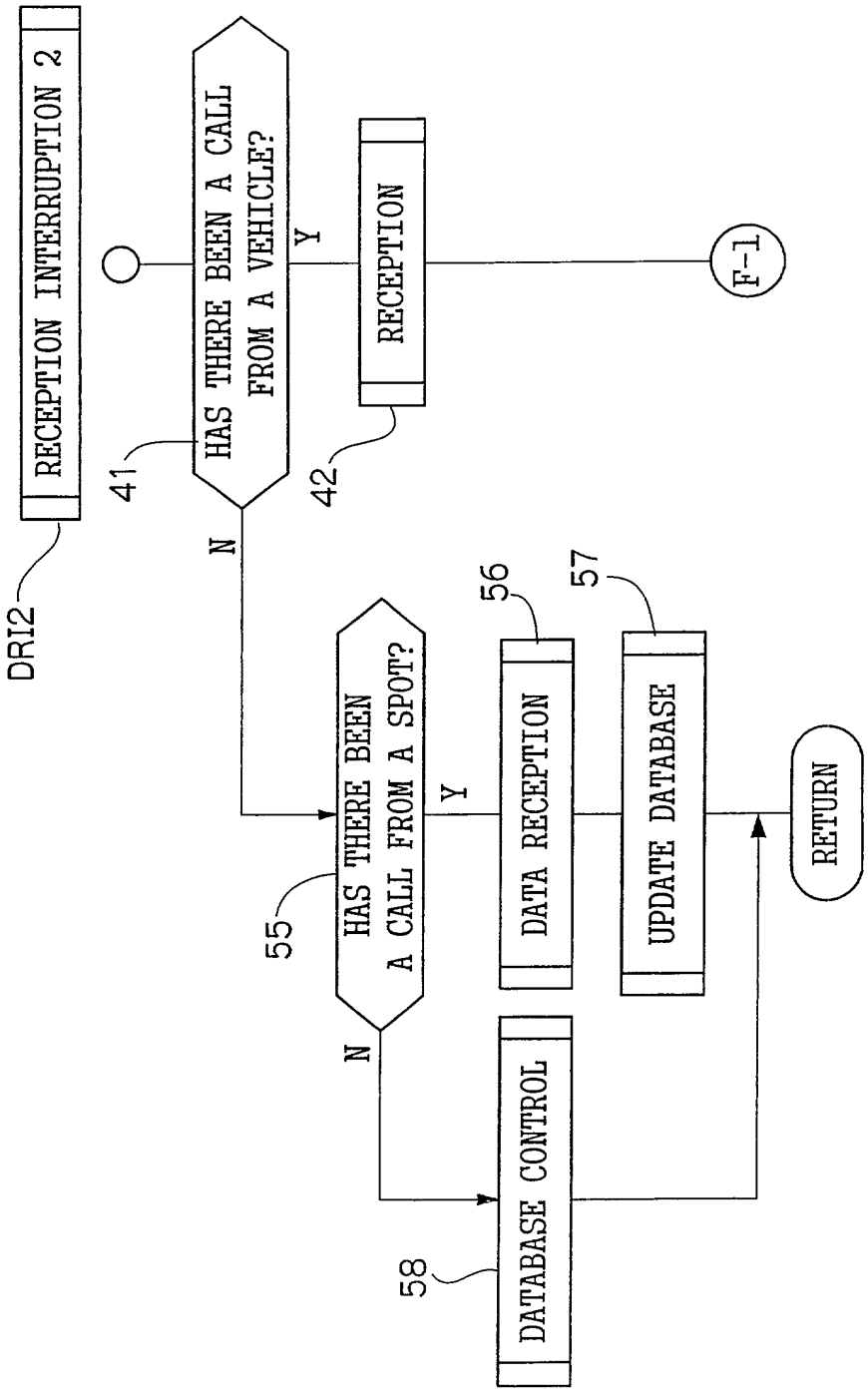


FIG.57B

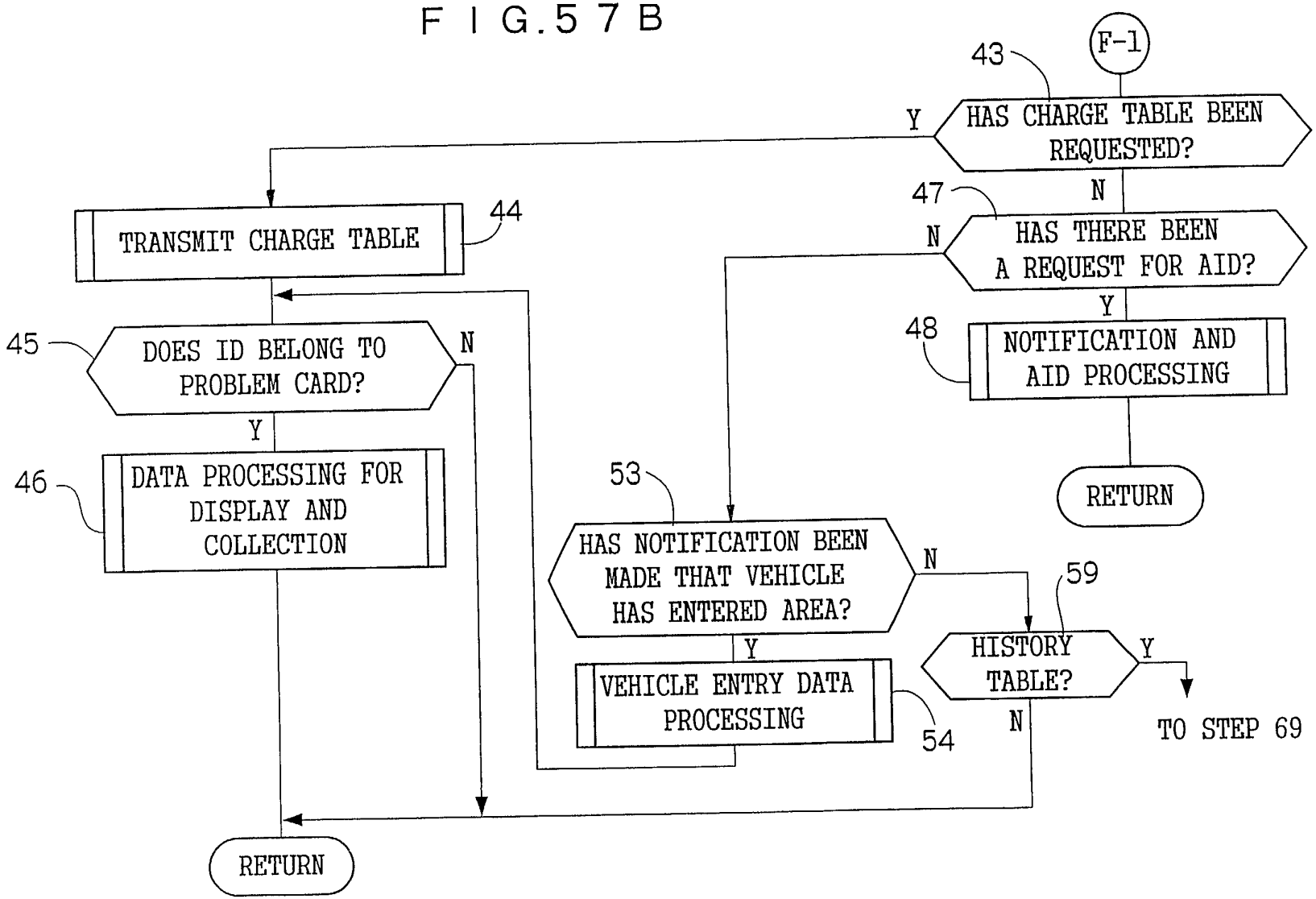
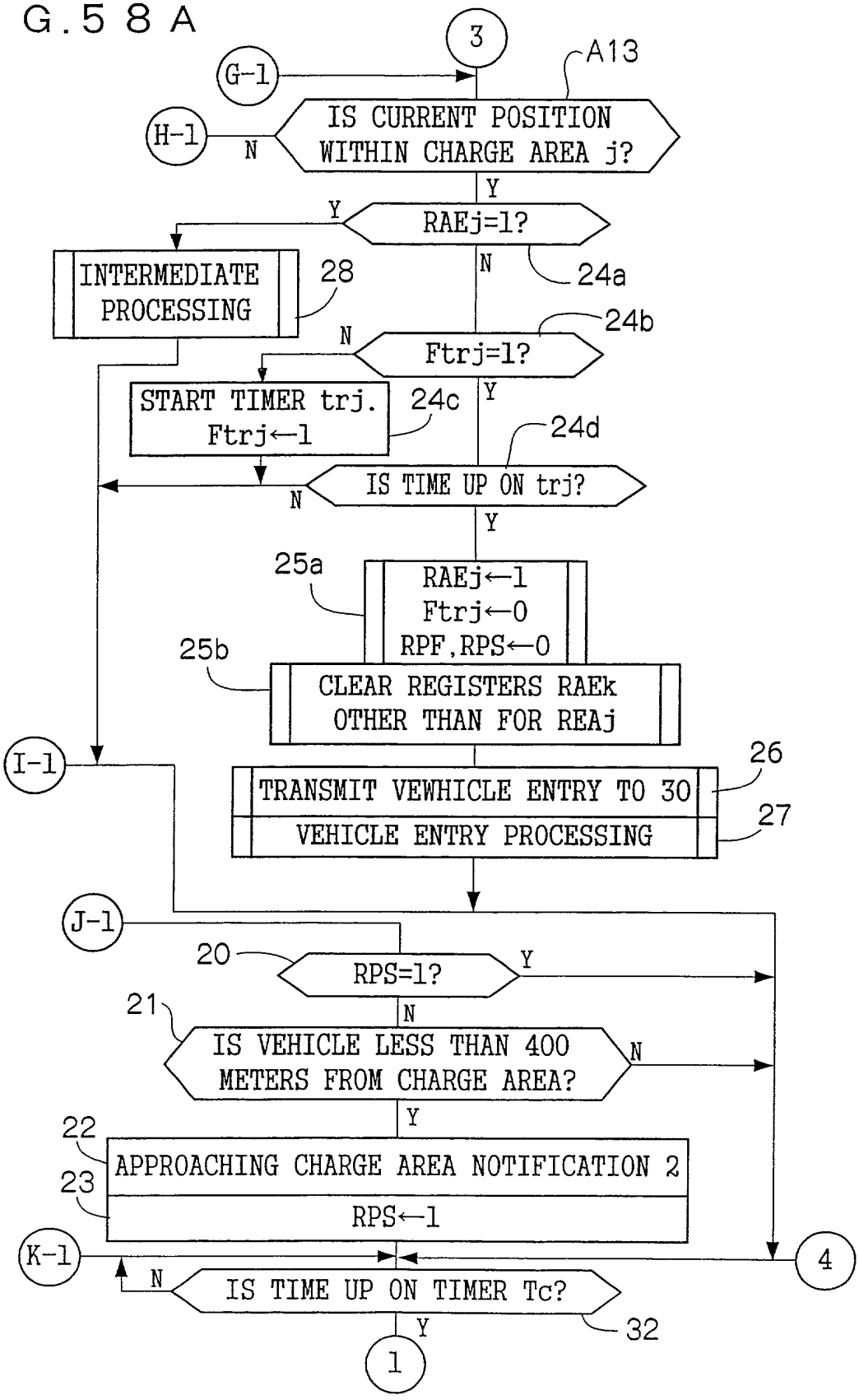
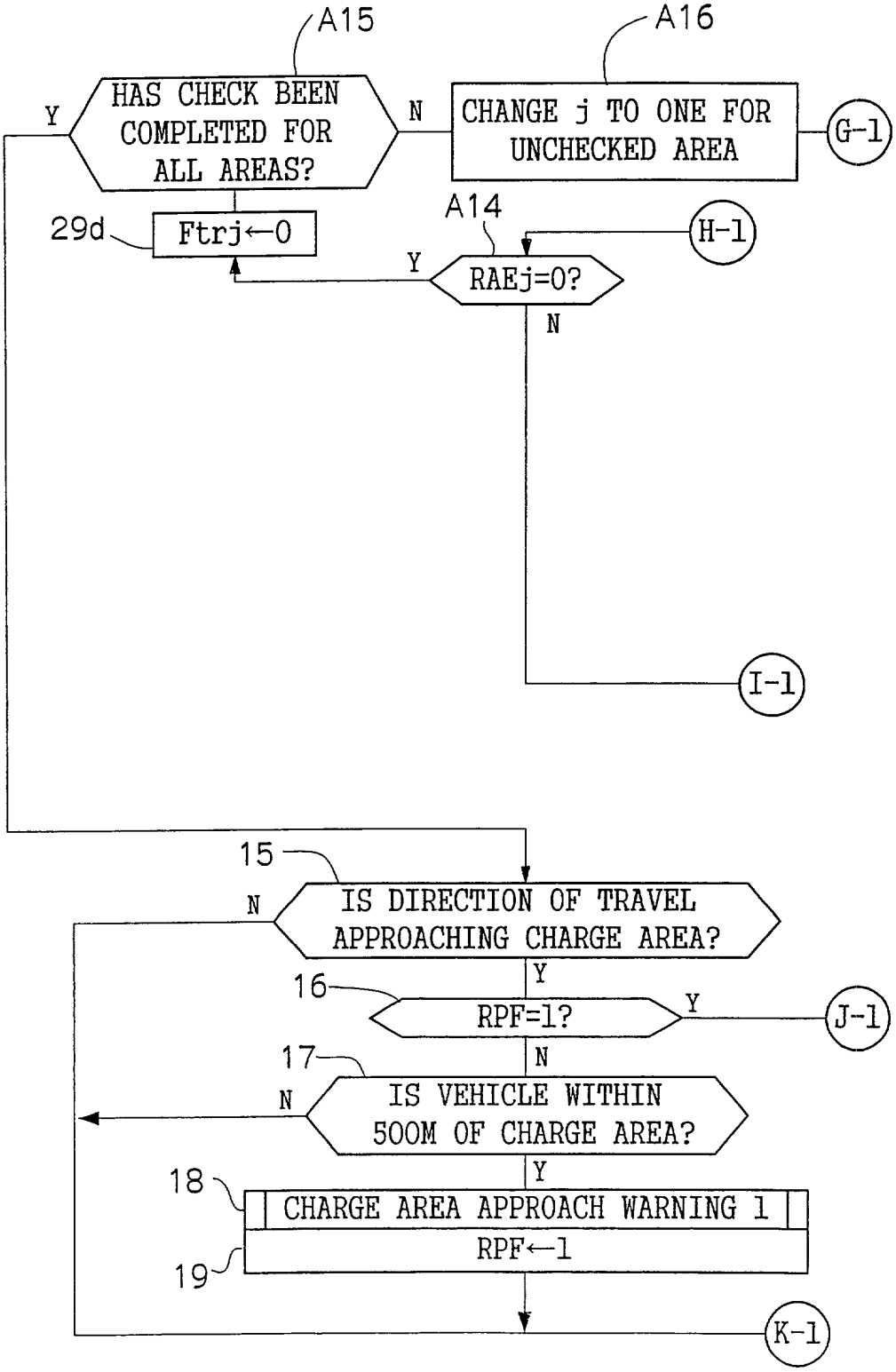

F-1
43
HAS CHARGE TABLE BEEN REQUESTED?
Y
N
47
HAS THERE BEEN A REQUEST FOR AID?
N
Y
48
NOTIFICATION AND AID PROCESSING
RETURN
TRANSMIT CHARGE TABLE
44
45
DOES ID BELONG TO PROBLEM CARD?
N
Y
46
DATA PROCESSING FOR DISPLAY AND COLLECTION
53
HAS NOTIFICATION BEEN MADE THAT VEHICLE HAS ENTERED AREA?
N
Y
VEHICLE ENTRY DATA PROCESSING
54
59
HISTORY TABLE?
Y
N
TO STEP 69
RETURN

FIG.58A



FOREIGN-2005-160

FIG.58B



JP2005-265650 A 2005.09.29

FIG.59A

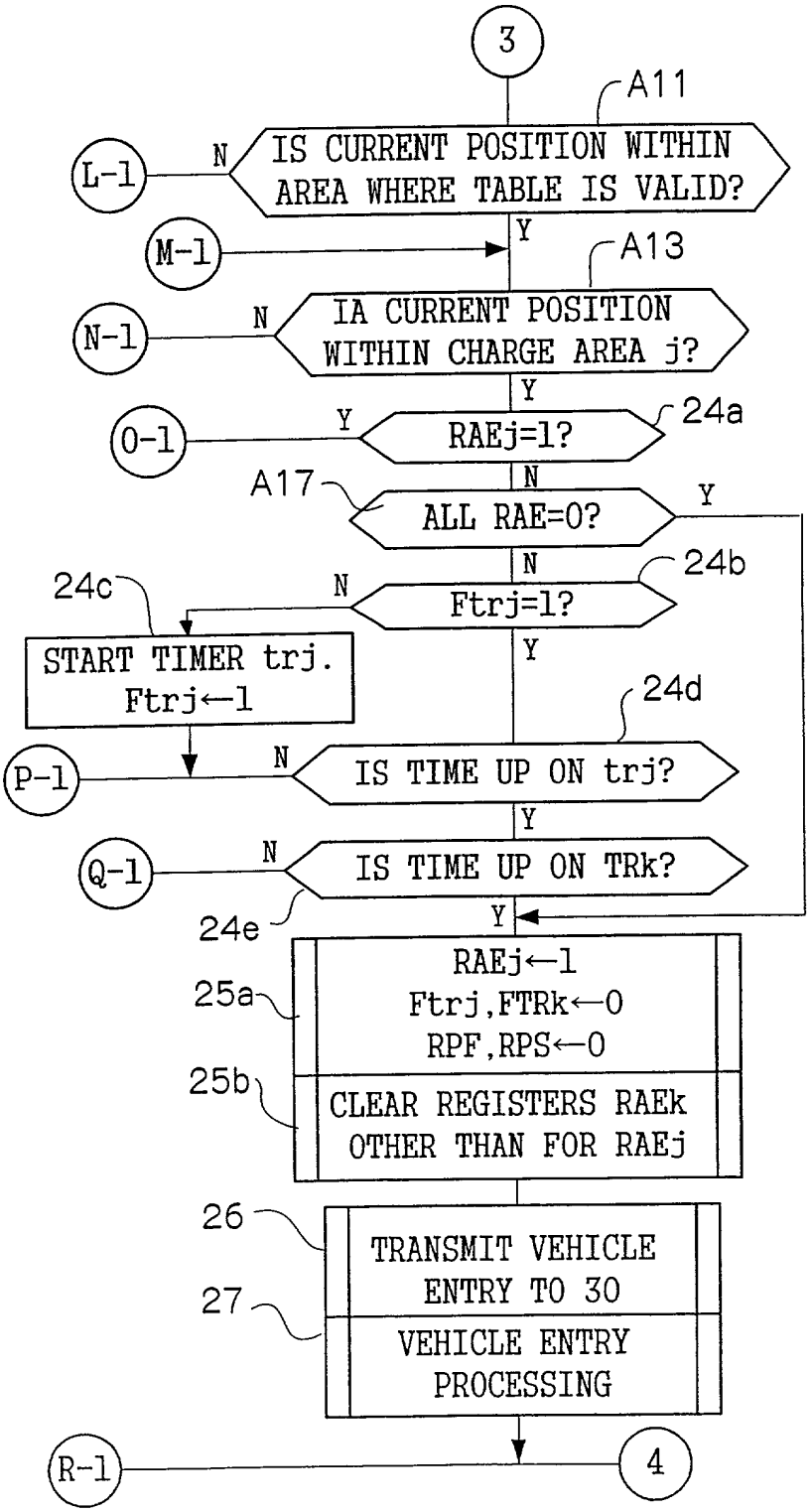


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FIG.59B

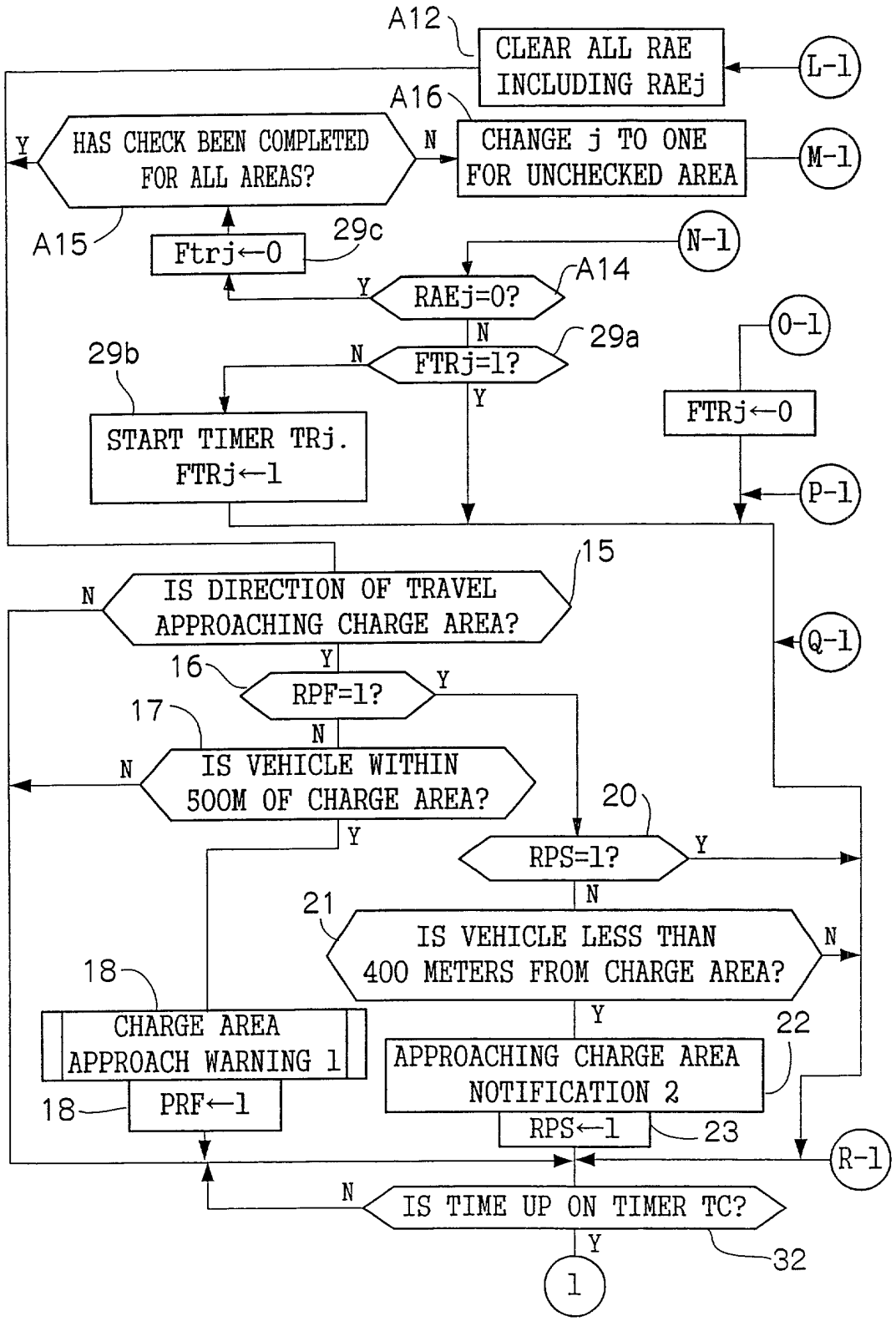
A12
CLEAR ALL RAE INCLUDING RAEj
L-1
A16
HAS CHECK BEEN COMPLETED FOR ALL AREAS?
Y
N
CHANGE j TO ONE FOR UNCHECKED AREA
M-1
A15
Ftrj←0
29c
N-1
RAEj=0?
A14
Y
N
FTRj=1?
29a
N
Y
29b
START TIMER TRj.
FTRj←1
0-1
FTRj←0
P-1
15
IS DIRECTION OF TRAVEL APPROACHING CHARGE AREA?
N
Y
Q-1
16
RPF=1?
Y
N
17
IS VEHICLE WITHIN 500M OF CHARGE AREA?
N
Y
20
RPS=1?
Y
N
21
IS VEHICLE LESS THAN 400 METERS FROM CHARGE AREA?
N
Y
18
CHARGE AREA APPROACH WARNING 1
18
PRF←1
APPROACHING CHARGE AREA NOTIFICATION 2
22
RPS←1
23
R-1
N
IS TIME UP ON TIMER TC?
Y
32
1

FIG.60

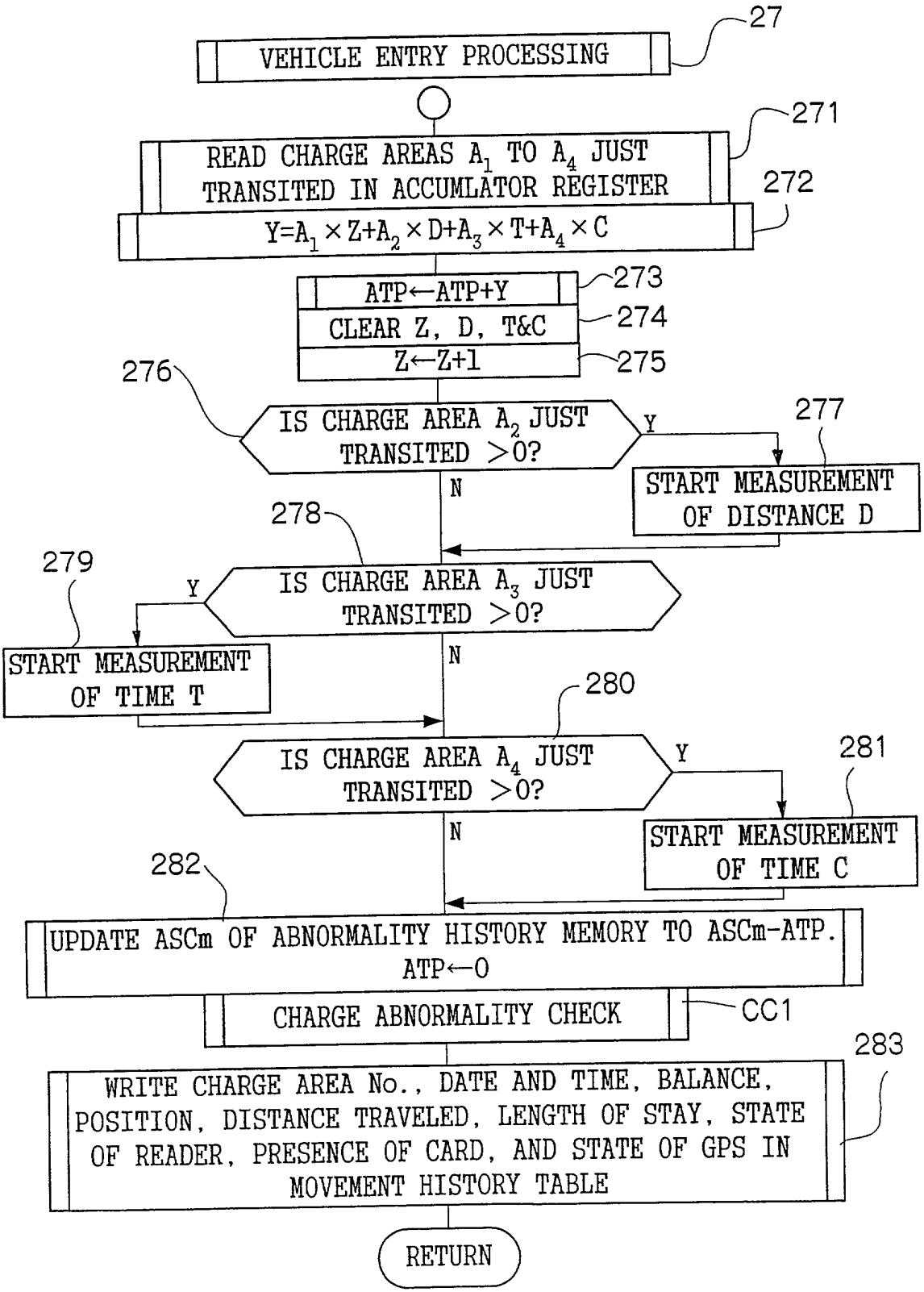

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FIG.61A

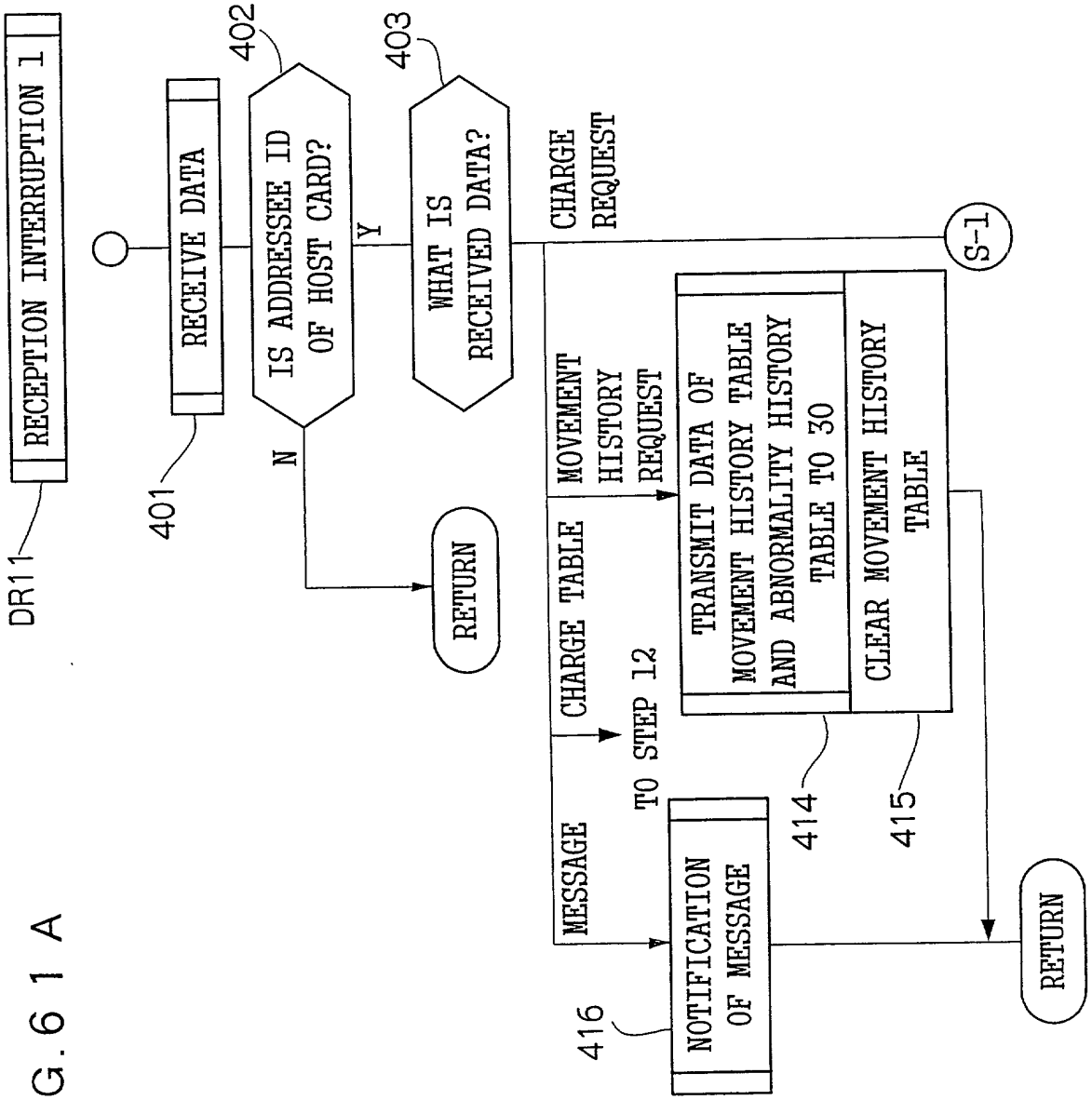


FIG.61B

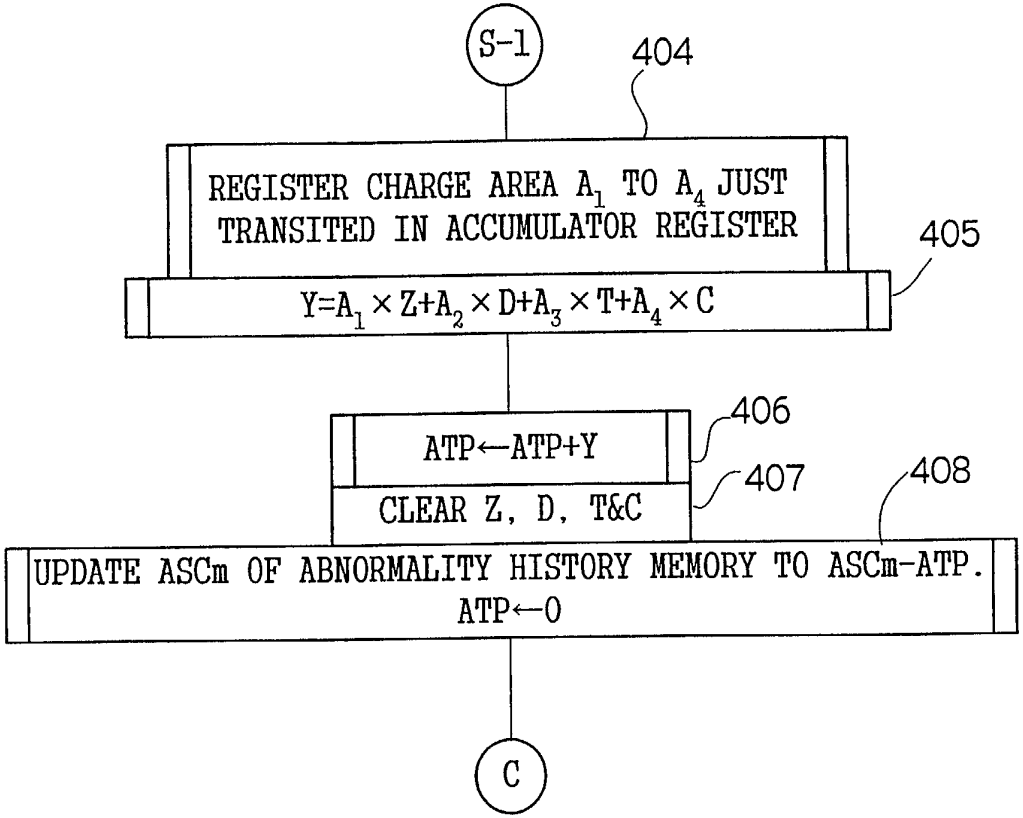

S-1
404
REGISTER CHARGE AREA A_1 TO A_4 JUST TRANSITED IN ACCUMULATOR REGISTER
405
$Y=A_1 \times Z+A_2 \times D+A_3 \times T+A_4 \times C$
406
ATP←ATP+Y
407
CLEAR Z, D, T&C
408
UPDATE ASCm OF ABNORMALITY HISTORY MEMORY TO ASCm-ATP.
ATP←0
C

FIG.62

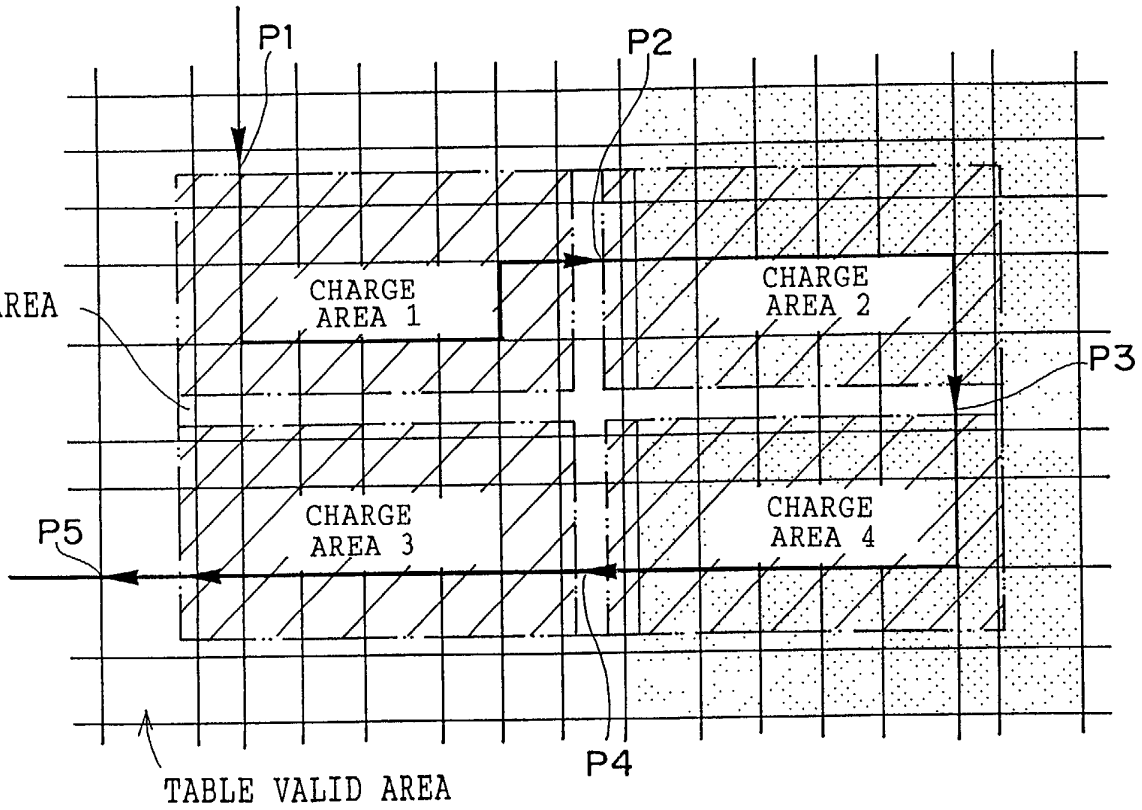
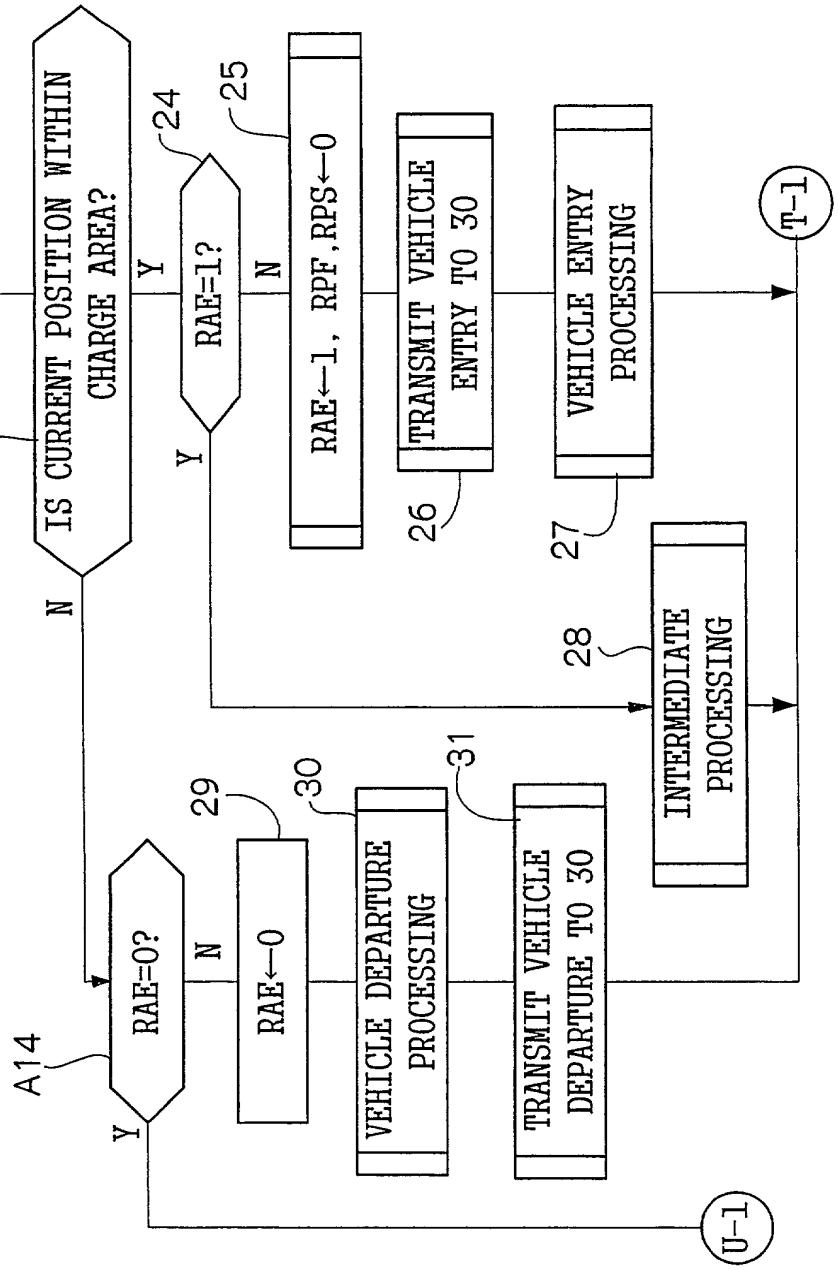

P1
P2
BUFFER AREA
CHARGE AREA 1
CHARGE AREA 2
P3
P5
CHARGE AREA 3
CHARGE AREA 4
P4
TABLE VALID AREA

FIG.63A


3
A13
IS CURRENT POSITION WITHIN CHARGE AREA?
N
Y
24
RAE=1?
Y
N
25
RAE←1, RPF, RPS←0
26
TRANSMIT VEHICLE ENTRY TO 30
27
VEHICLE ENTRY PROCESSING
T-1
28
INTERMEDIATE PROCESSING
A14
RAE=0?
Y
N
29
RAE←0
30
VEHICLE DEPARTURE PROCESSING
31
TRANSMIT VEHICLE DEPARTURE TO 30
U-1

T06260 "2286260

FIG.63B

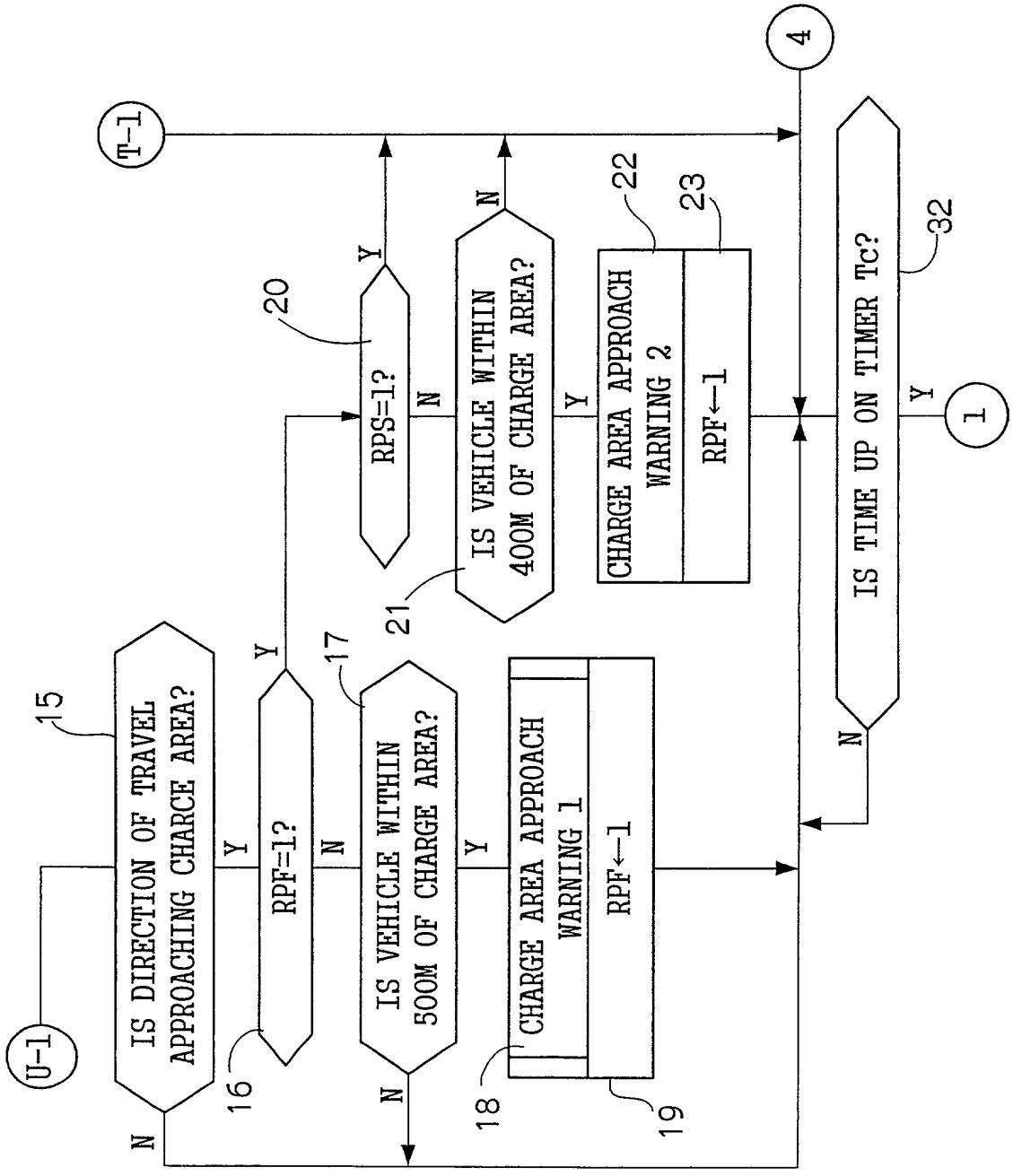


FIG.64

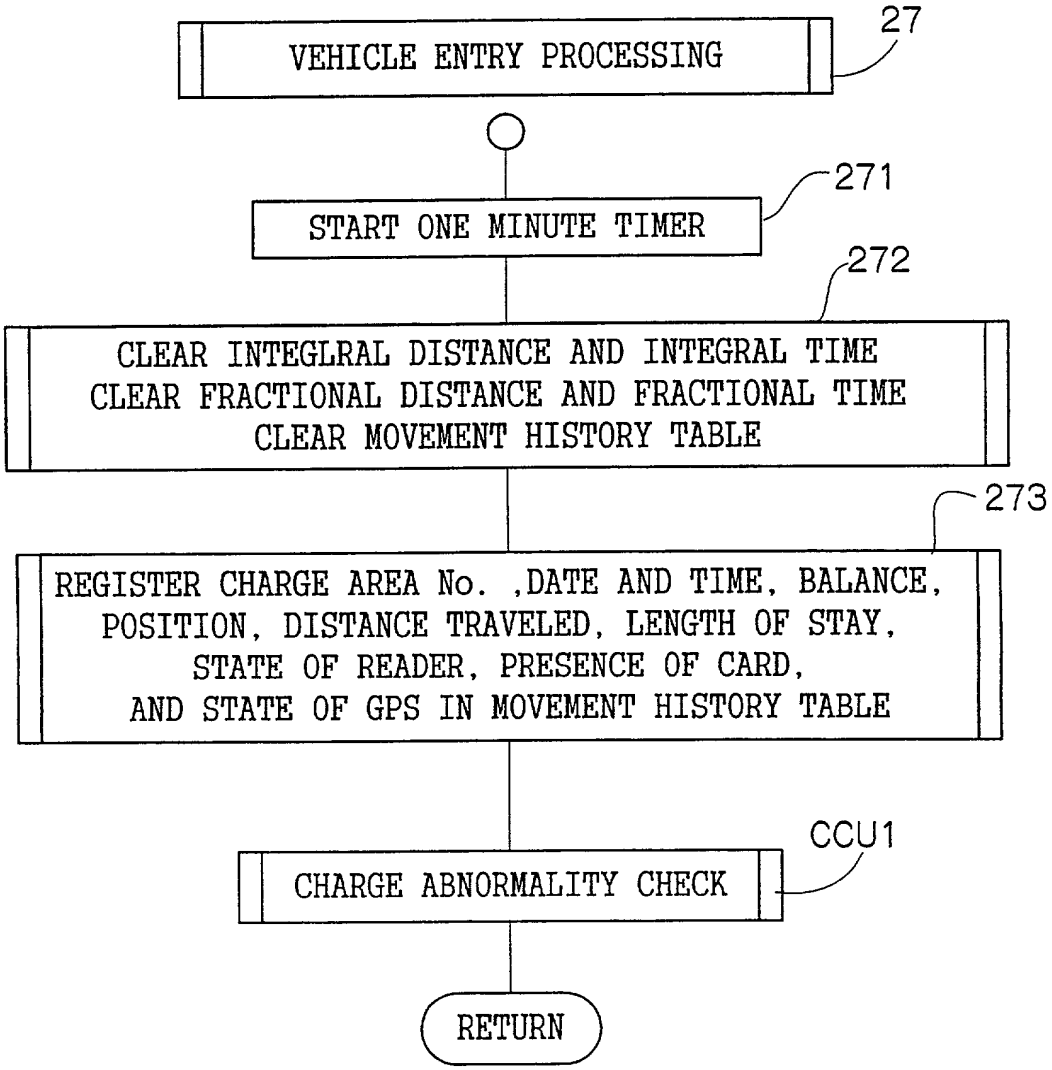


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FIG.65

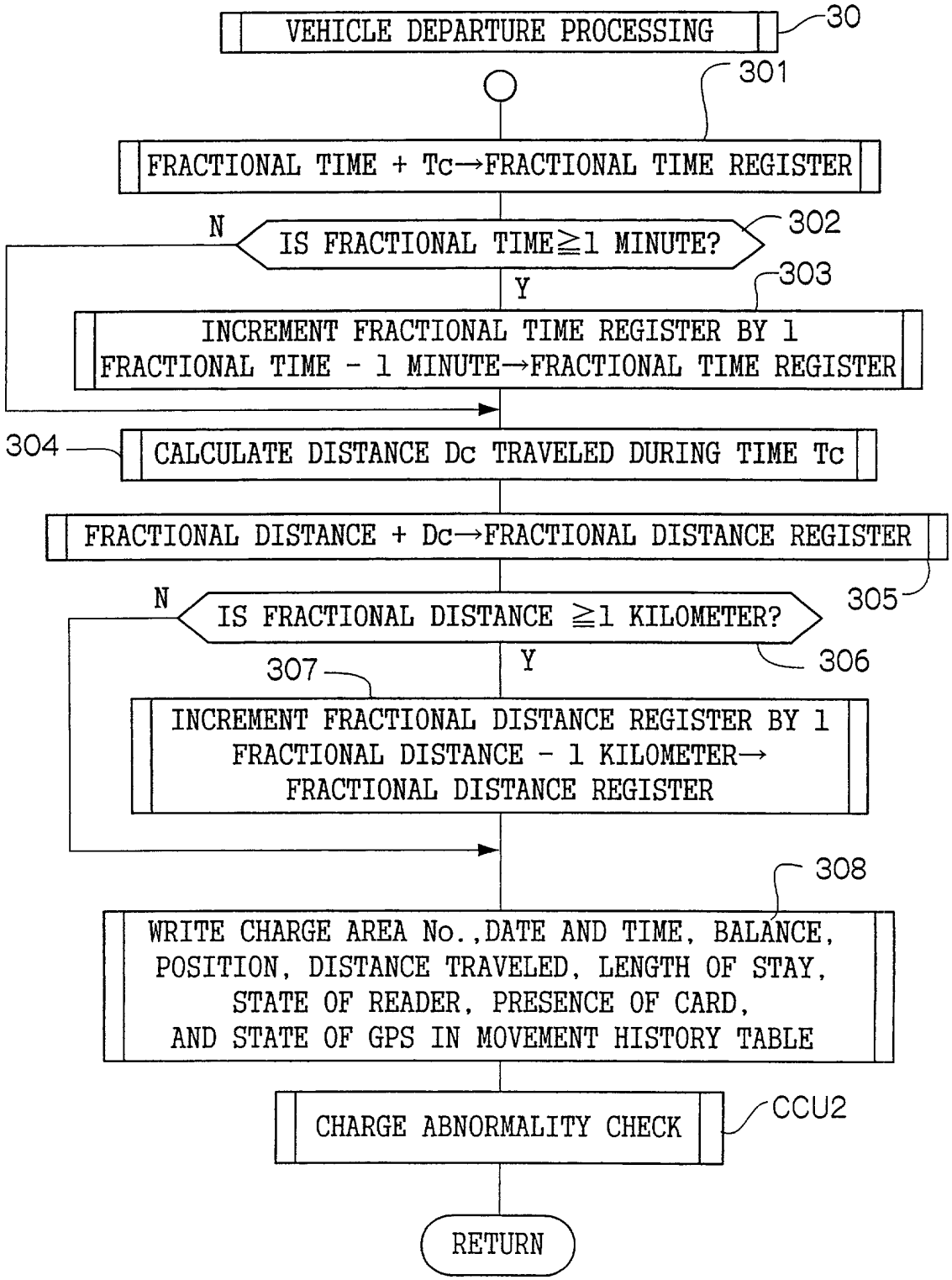
VEHICLE DEPARTURE PROCESSING
30
301
FRACTIONAL TIME + Tc→FRACTIONAL TIME REGISTER
N
IS FRACTIONAL TIME≧1 MINUTE?
302
Y
303
INCREMENT FRACTIONAL TIME REGISTER BY 1
FRACTIONAL TIME - 1 MINUTE→FRACTIONAL TIME REGISTER
304
CALCULATE DISTANCE Dc TRAVELED DURING TIME Tc
FRACTIONAL DISTANCE + Dc→FRACTIONAL DISTANCE REGISTER
305
N
IS FRACTIONAL DISTANCE ≧1 KILOMETER?
306
Y
307
INCREMENT FRACTIONAL DISTANCE REGISTER BY 1
FRACTIONAL DISTANCE - 1 KILOMETER→
FRACTIONAL DISTANCE REGISTER
308
WRITE CHARGE AREA No.,DATE AND TIME, BALANCE,
POSITION, DISTANCE TRAVELED, LENGTH OF STAY,
STATE OF READER, PRESENCE OF CARD,
AND STATE OF GPS IN MOVEMENT HISTORY TABLE
CHARGE ABNORMALITY CHECK
CCU2
RETURN

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FIG.66A

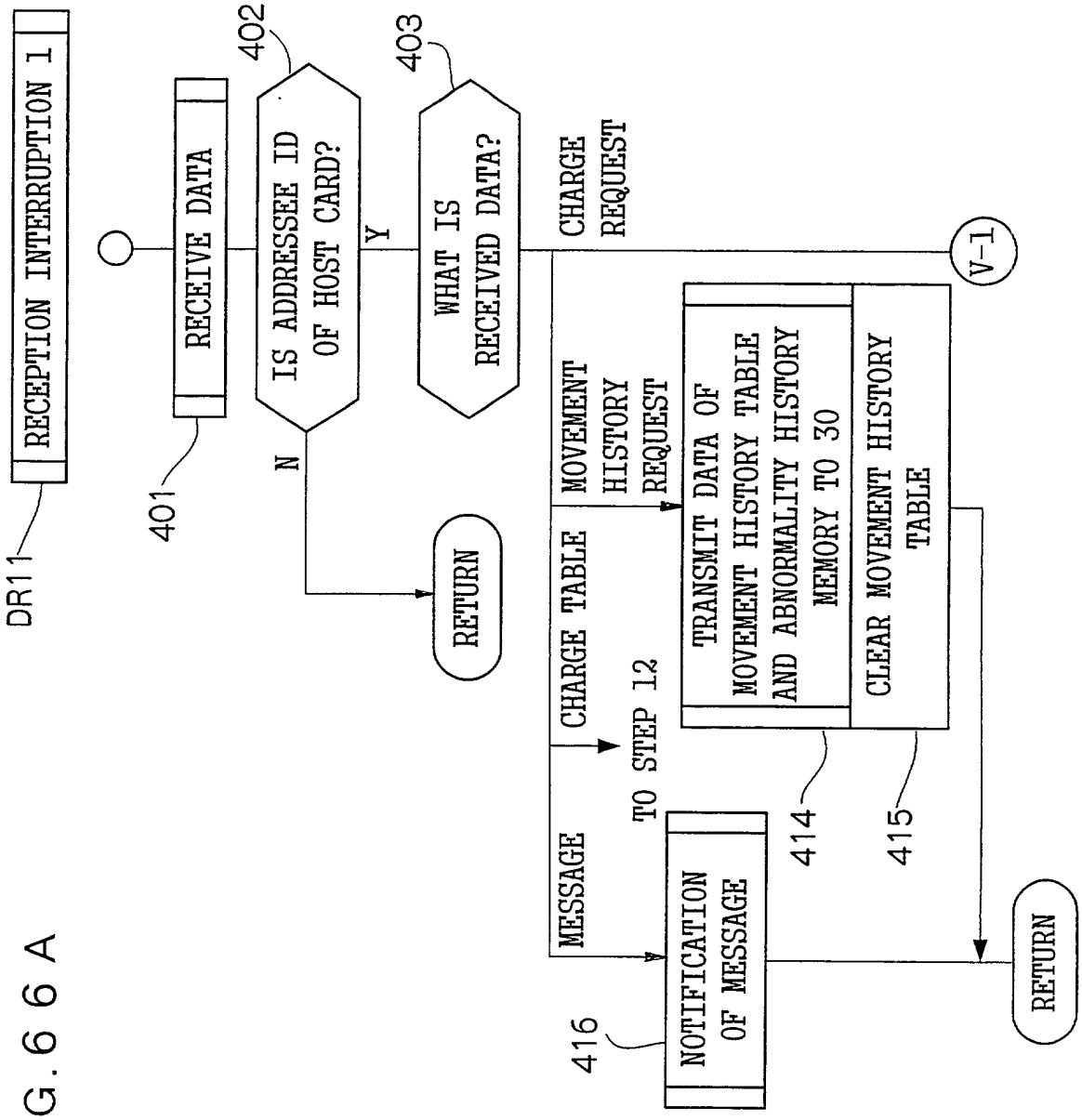

FIG.66B

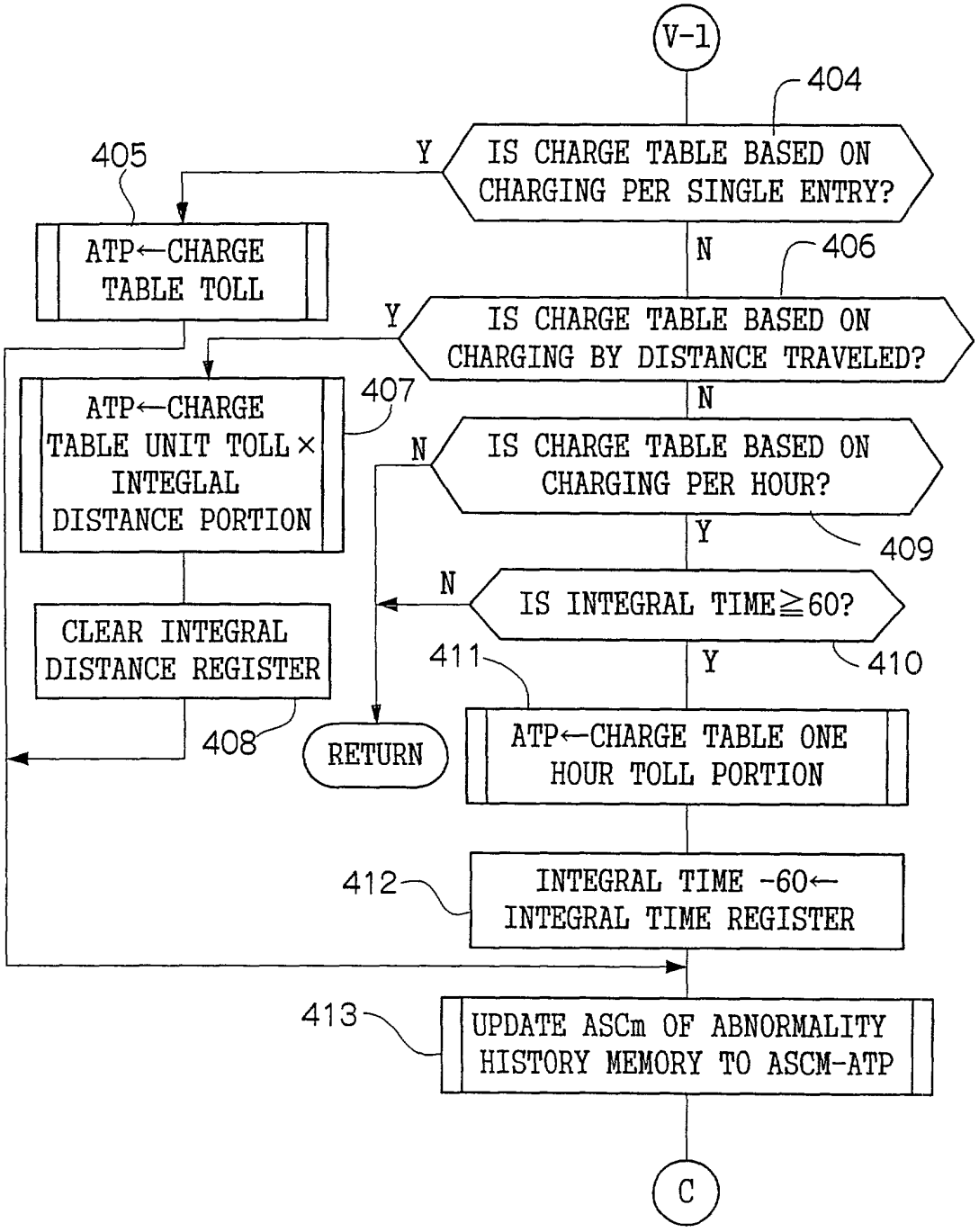

FIG.66-JP-S63-85804

FIG.67

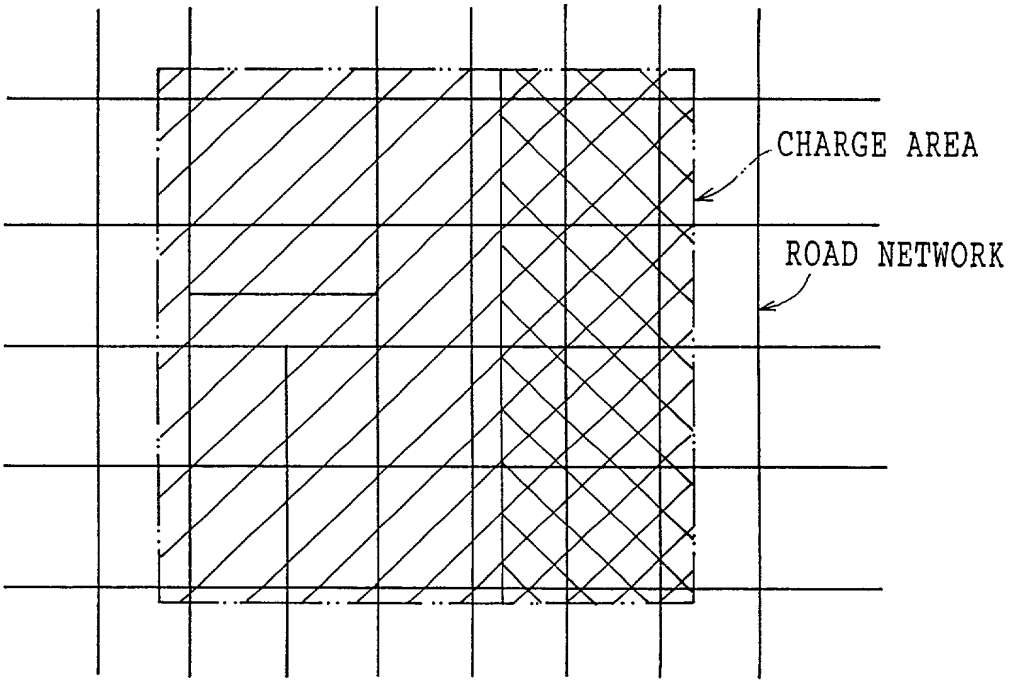

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FIG.68A

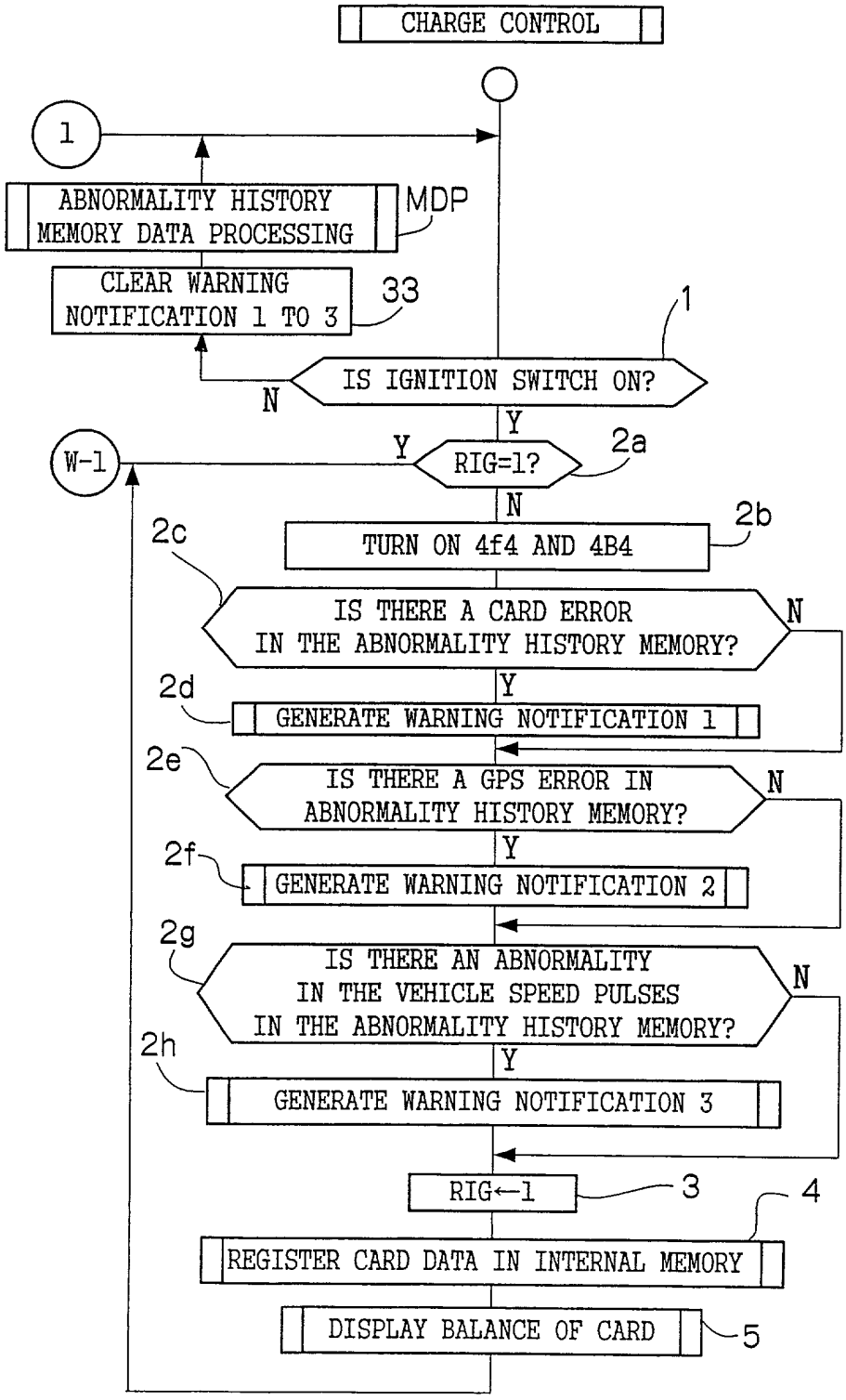

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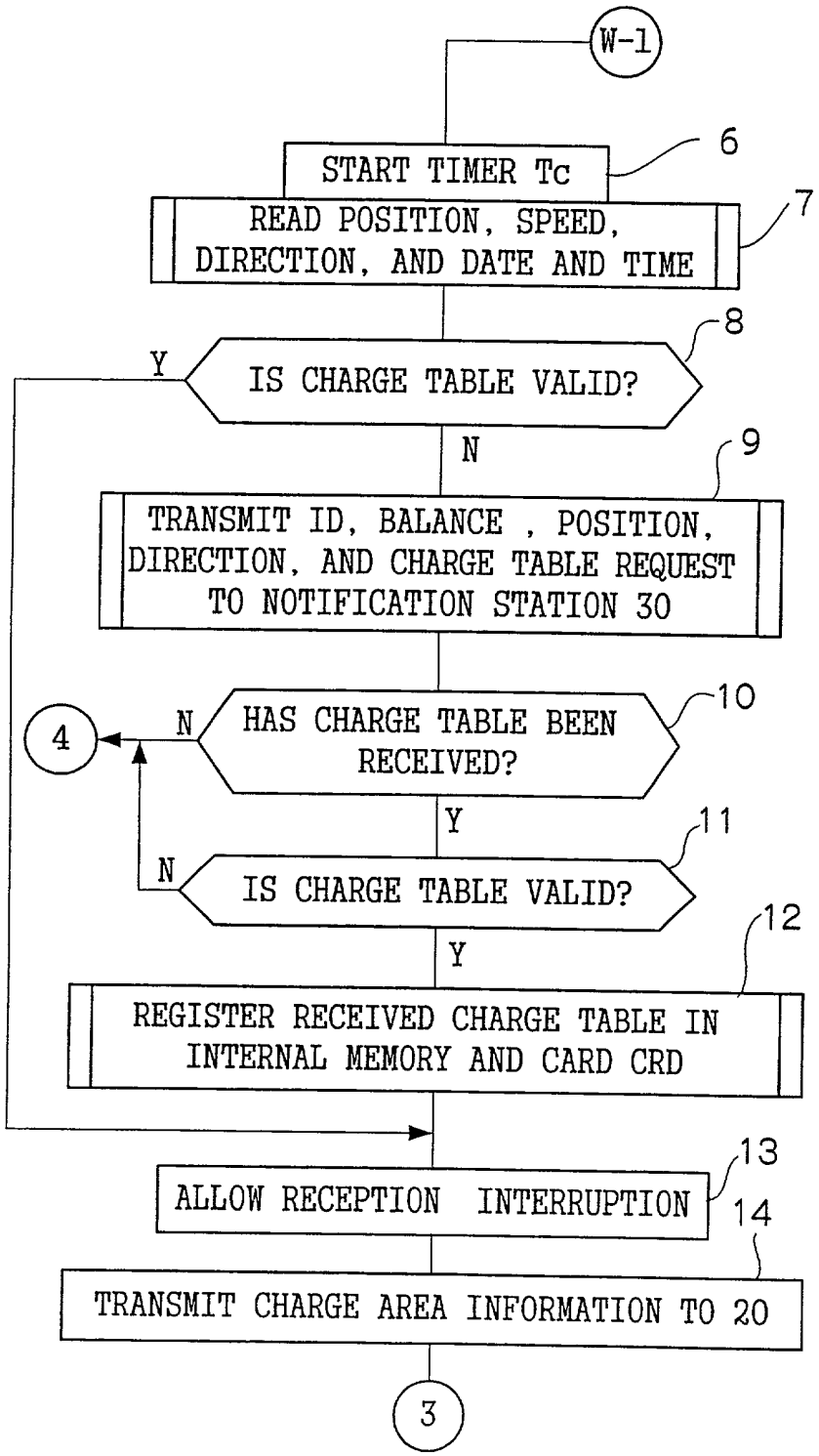
FIG.68B



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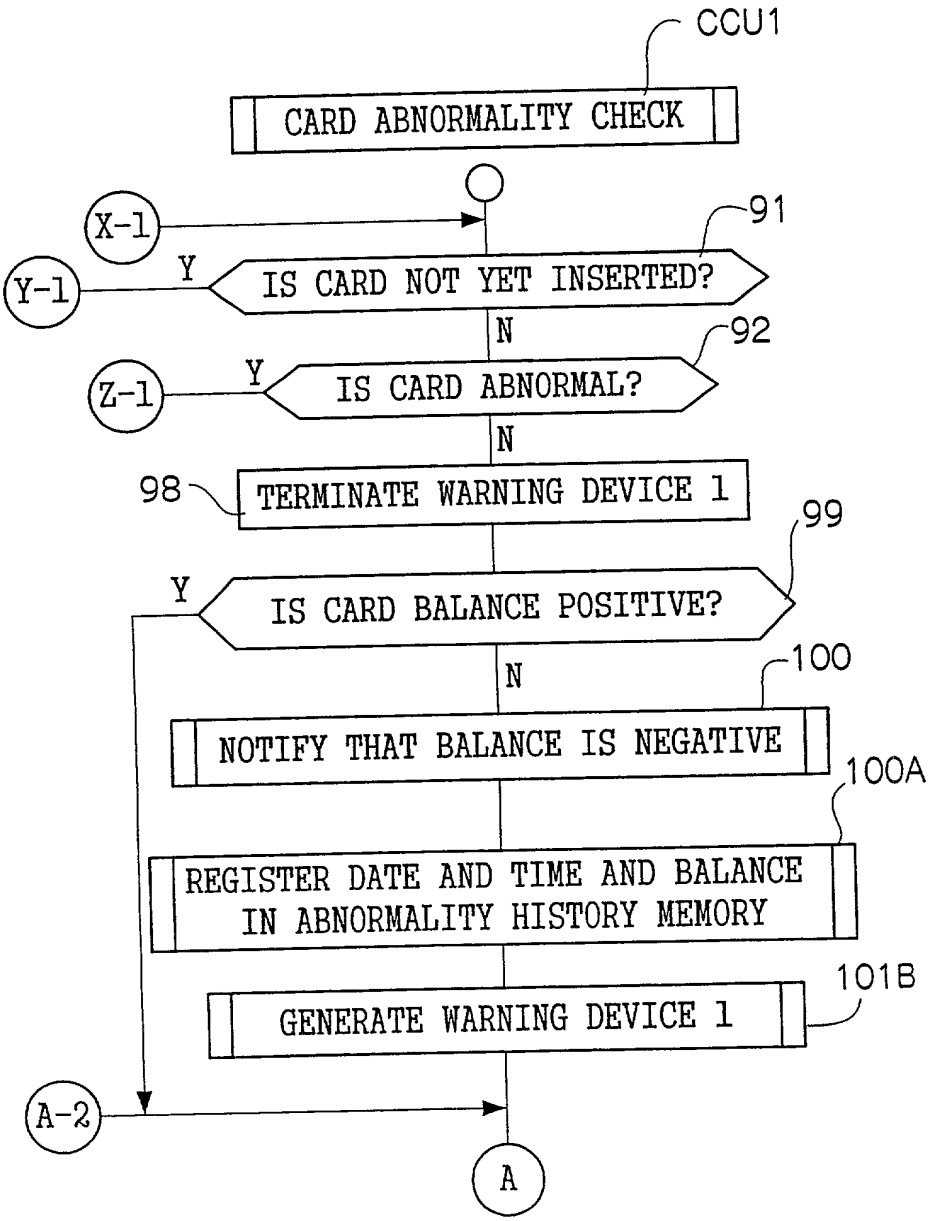
F I G. 6 9 A



JP2005-352927-A 2005.12.22

FIG.69B

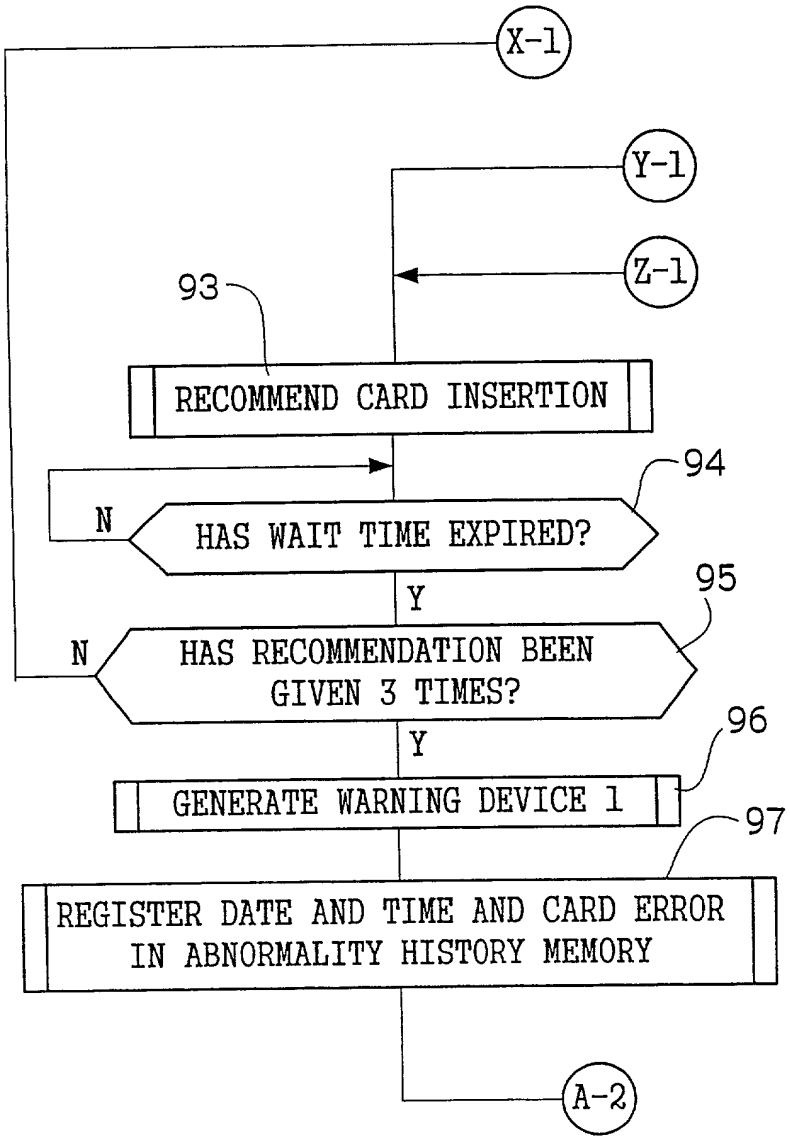


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FIG.70A

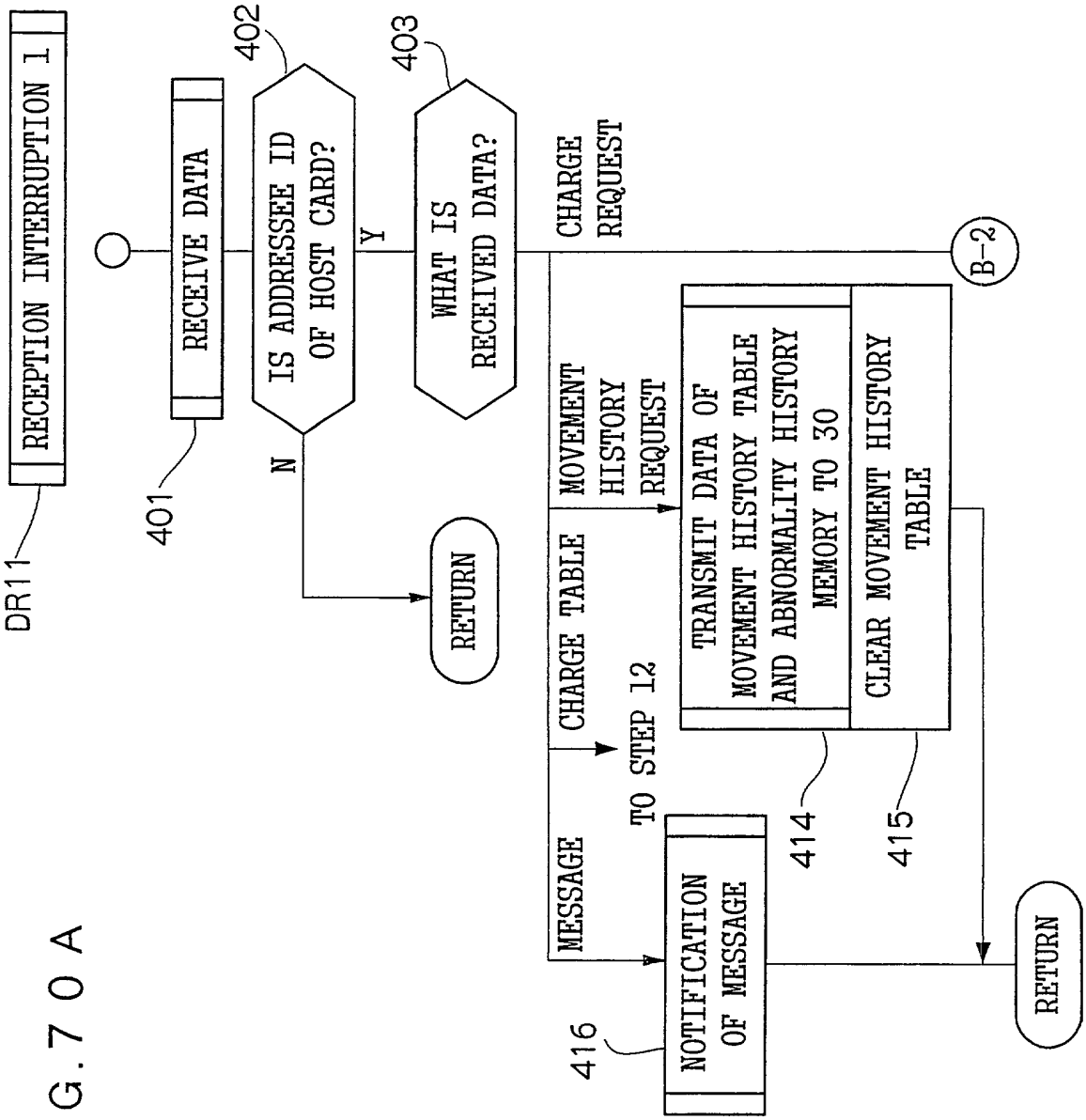
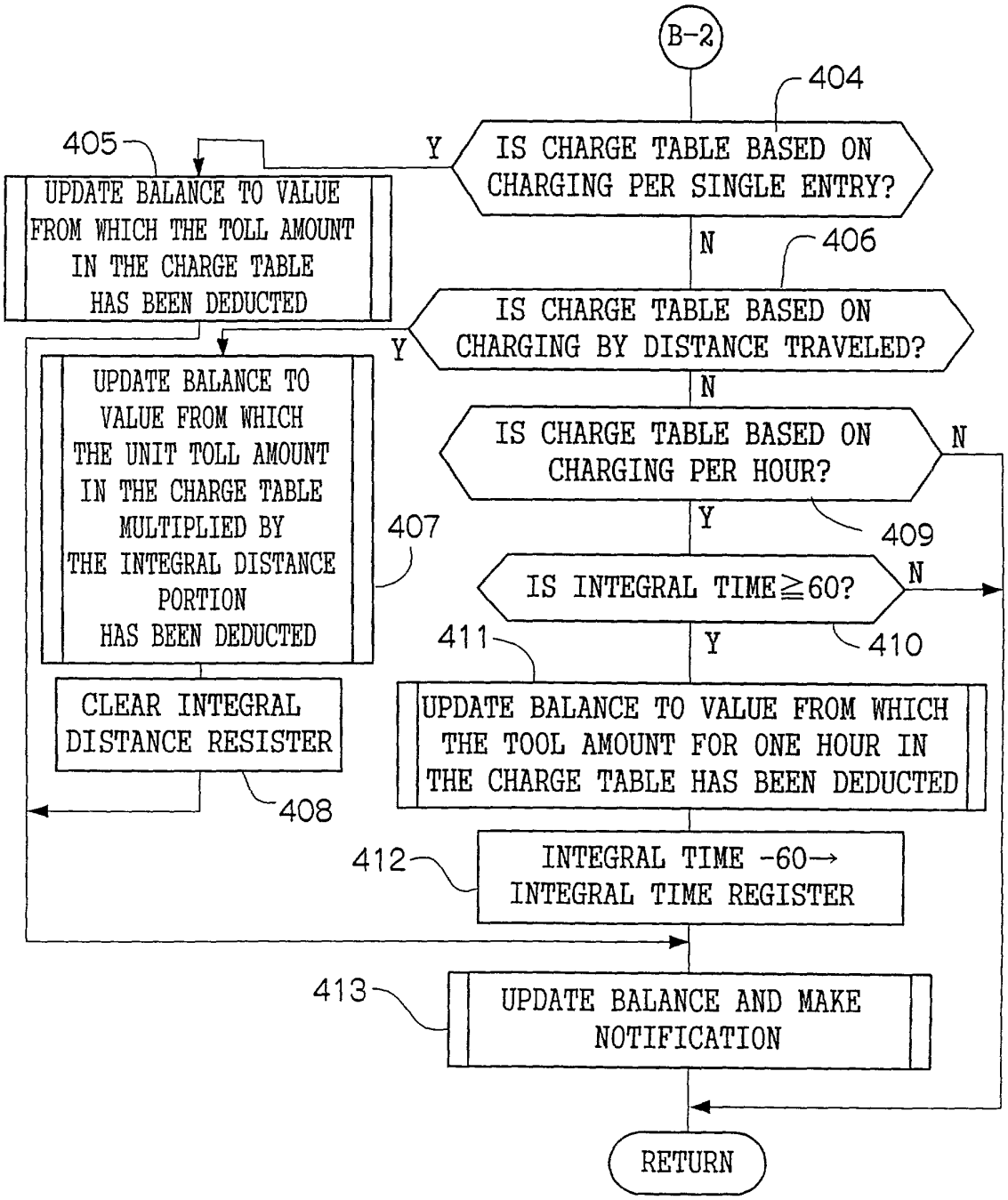


FIG.70B


B-2
404
IS CHARGE TABLE BASED ON CHARGING PER SINGLE ENTRY?
Y
405
UPDATE BALANCE TO VALUE FROM WHICH THE TOLL AMOUNT IN THE CHARGE TABLE HAS BEEN DEDUCTED
N
406
IS CHARGE TABLE BASED ON CHARGING BY DISTANCE TRAVELED?
Y
UPDATE BALANCE TO VALUE FROM WHICH THE UNIT TOLL AMOUNT IN THE CHARGE TABLE MULTIPLIED BY THE INTEGRAL DISTANCE PORTION HAS BEEN DEDUCTED
407
CLEAR INTEGRAL DISTANCE RESISTER
408
N
IS CHARGE TABLE BASED ON CHARGING PER HOUR?
N
Y
409
IS INTEGRAL TIME≧60?
N
Y
410
411
UPDATE BALANCE TO VALUE FROM WHICH THE TOOL AMOUNT FOR ONE HOUR IN THE CHARGE TABLE HAS BEEN DEDUCTED
412
INTEGRAL TIME -60→ INTEGRAL TIME REGISTER
413
UPDATE BALANCE AND MAKE NOTIFICATION
RETURN